FLIGHT
and
AIRCRAFT ENGINEER

Editorial Director G. GEOFFREY SMITH, M.B.E.
Editor - - C. M. POULSEN
Assistant Editor - MAURICE A. SMITH, D.F.C. (WING CDR., R.A.F.V.R.)
Art Editor - - JOHN YOXALL

FIRST AERONAUTICAL WEEKLY IN THE WORLD : FOUNDED 1909

Editorial, Advertising and Publishing Offices: DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1
Telegrams : Flightpres, Sedist, London. Telephone : Waterloo 3333 (50 lines.)

COVENTRY: 8 - 10, CORPORATION ST. Telegrams : Autocar, Coventry. Telephone : Coventry 5210.
BIRMINGHAM, 2: KING EDWARD HOUSE, NEW STREET. Telegrams : Autopress, Birmingham. Telephone : Midland 7191 (7 lines).
MANCHESTER, 3: 260, DEANSGATE. Telegrams : Iliffe, Manchester. Telephone : Blackfriars 4412.
GLASGOW, C.2: 26B, RENFIELD ST. Telegrams : Iliffe, Glasgow. Telephone : Central 4857

SUBSCRIPTION RATES : Home and Abroad : Year, £3 1 0. 6 months, £1 10 6.

Registered at the G.P.O. as a Newspaper

No. 1989. Vol. LI February 6th, 1947 Thursdays, One Shilling.

The Outlook

Specialist Reserves

THE key sentence pronounced by the Secretary of State for Air at his recent conference regarding non-regular Air Force units was that, with the smallest possible diversion of manpower from ordinary needs, and with the financial resources which were available, we wish to make our air strength as great as possible. He added "I should say that both the short-term symptoms and long-term prospects for peace are better than they have been since the end of the war. If we want to make our air strength as great as possible it is because we desire to assist actively in maintaining peace, to support the United Nations if its law should be challenged, and to withstand aggression wherever it should appear."

If any proof were required of the extent and scope of the help that even part-trained Reserve units can give in a time of emergency, it was provided by the experience at the beginning of the last war when such men and women immediately assumed leading roles in every branch, operational, technical and administrative of the Royal Air Force.

This country is not preparing for another war—far from it—but experience has shown that we must be able to defend ourselves, and as Mr. Noel-Baker said "after twenty years of Mussolini and six years of Hitler it will be a long time before we get really straight on the international scene." Air defence of a country to-day does not just entail the mastery of the sky above and around its boundaries. The nature of offensive weapons is now such that interception of a weapon in the early stages of its travel, or even before it is launched, must be attempted.

There will be no difficulty in obtaining a surplus of aircrew volunteers, but it remains to be seen whether the rather less interesting but just as essential branches of the Reserve will attract sufficient volunteers. There is no doubt that as great a pride develops within the non-regular units for their work and associations as can be observed among any of the regular forces which boast historical names and connections.

It has taken a long time—too long—to organize the several specialist R.A.F.V.R. units now introduced, but they will nevertheless be welcomed by large numbers of ex-officers, men and women, who are anxious again to be associated, actively or otherwise, with their old Service.

Tribute to Transport Command

AIR MARSHAL the Hon. Sir Ralph Cochrane's lecture describing the development of air transport during the war, an abstract of which appears on pages 146-147, is by no means the most exhaustive, and certainly not the most academic, paper delivered before the Royal Aeronautical Society; but it is full of facts and observations which, with the resurgence of commercial flying, have a special value.

Extensive as they were (in twenty-one months more passenger-miles were flown than were completed by British civil aircraft during the preceding twenty-one years), the wartime operations of Transport Command were on a small scale compared with those of the U.S.A.T.C. Each month, while the British Command was moving 10,000 troops in each direction on the India run, its American counterpart was flying 50,000 troops across the Atlantic.

It will be gathered from the Air Marshal's account, however, that, much as we were indebted to American equipment—in particular to the Dakota aircraft now the subject of such controversy—our operating technique was based largely on our own experience and research. In the second connection special praise is due to the Telecommunications Research Establishment for their work on a device to warn pilots of dangerous cumulo-nimbus clouds. The possibilties of such equipment were referred to in *Flight* last year, when trials were conducted by T. R. E. in South-East Asia, and it is reassuring to know that further tests, to determine its value in negoti-

ating cold fronts and in detecting bad icing conditions, will be attended by representatives of the Ministry of Civil Aviation and the Airways Corporations.

With the inevitable reduction in the size of Transport Command the study of such aids may now be undertaken with greater thoroughness, and by fostering and proving new devices and techniques for application to British transport aircraft—Service and civil—the Command will assume an even greater importance and responsibility. That A. V-M. Collier—without whose work the Command would never have achieved what it did—should now be at the Ministry of Civil Aviation is in itself a reason for satisfaction.

Locked Controls

AFTER the Dakota accident at Copenhagen there has been a good deal of surprise at the fact that an old and experienced pilot like Geyssendorffer——who was one of K.L.M.'s best, and that is saying a good deal—could have been so forgetful as to omit to test his controls before taking off. The explanation seems to be that with the elevator locks used in the Dakotas it is still possible to move the control column a certain amount. But, even so, the very regrettable accident has drawn attention to the need for the universal application of some form of control lock which will positively prevent the aircraft being taken off until the controls are free.

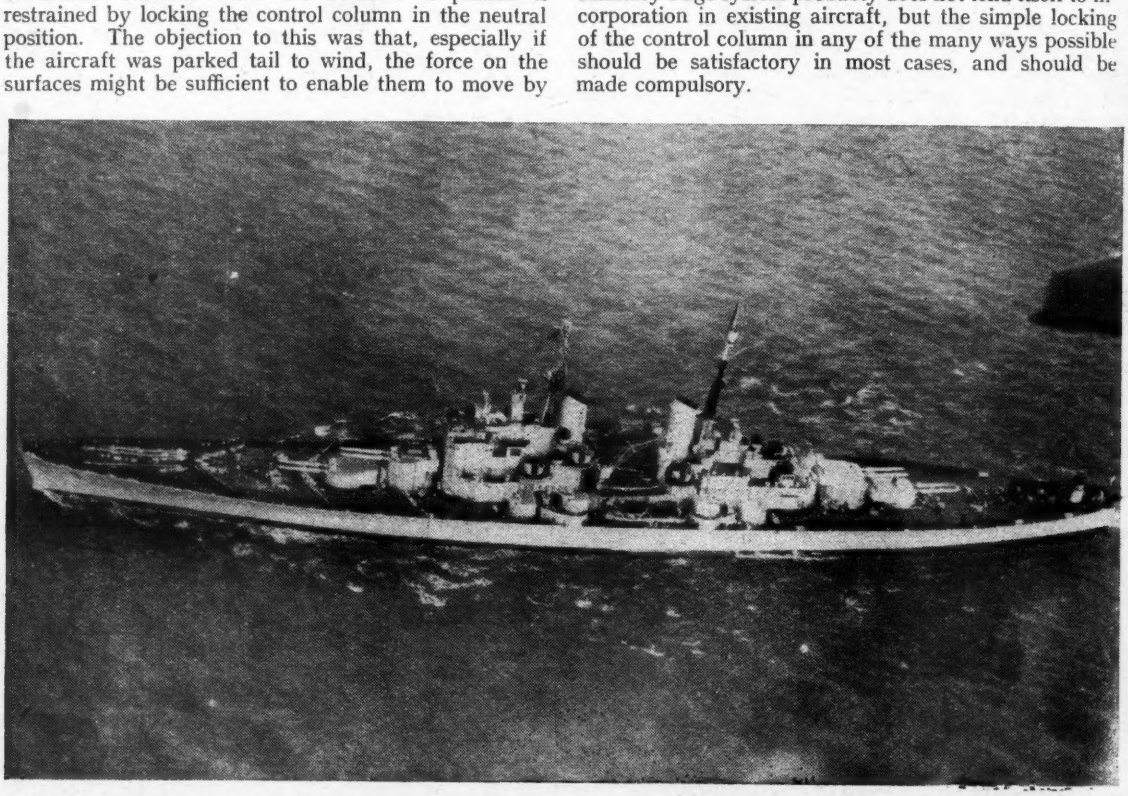
Several systems are already in use on different types of aircraft. The simple method of wedges or yokes which hold elevators and ailerons in the neutral position must be abandoned. In some aircraft the flapping of control surfaces when the machine is parked is restrained by locking the control column in the neutral position. The objection to this was that, especially if the aircraft was parked tail to wind, the force on the surfaces might be sufficient to enable them to move by stretching the control cables. Nowadays, long runs of control cables are the exception, and the question of cable stretch should not arise.

Apart from this, however, there can be very considerable loads on the control surfaces themselves, and on their hinges, and obviously the ideal method is one in which an internal locking device on the control surfaces is incorporated in the original design, so arranged that the control column and wheel cannot be moved until the locks have been released. In point of fact such an arrangement was recommended for new aircraft by the Joint Airworthiness Committee some months ago.

One way of achieving an even more foolproof arrangement is the new Handley Page system incorporated in Hermes and Hastings aircraft. When the control surfaces are locked in the neutral position, the pilot is unable to open his throttles, and thus obviously all risk of a take-off with locked controls is eliminated. The Handley Page system probably does not lend itself to incorporation in existing aircraft, but the simple locking of the control column in any of the many ways possible should be satisfactory in most cases, and should be made compulsory.

CONTENTS

Outlook	129
Flying-Boats	131
Royal Escort	136
Science is Measurement	137
Britain's Test Pilots	138
Here and There	140
The de Havilland Ghost (DGT/50)	142
Air Transport During the War	146
Civil Aviation News	148
Correspondence	151
Service Aviation	152



NINTH OF HER LINE: H.M.S. *Vanguard* seen from a Sunderland as she sailed from Portsmouth last Saturday bearing the Royal Family to South Africa (see page 136). The Union Jack can be seen at the jackstaff, the Royal Standard at the main, a second Union Jack at the port yardarm and the Admiralty Flag at the starboard yardarm.

FLYING-BOATS

Their Case Ably Argued by Two Distinguished Lecturers: Especially Favourable in Large Sizes

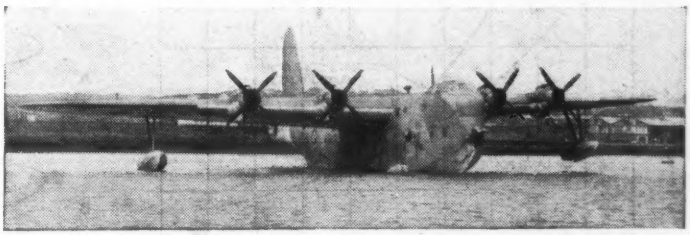
REFERENCE was made in our Editorial Comment last week to the two lectures given recently on the place of the flying-boat in commercial aviation of the future: "Recent Developments in Flying-boats" by Mr. Henry Knowler, Saunders-Roe chief designer, and "The Flying-boat and its Commercial Future," by Mr. Peter Masefield, Director-General of Long-Term Planning and Projects at the Ministry of Civil Aviation. Mr. Knowler was giving the nineteenth Thomas Lowe Gray Lecture to the Institution of Mechanical Engineers, and Mr. Masefield was addressing the Air Transport Session of the U.S. Institute of the Aeronautical Sciences in New York

Illustrated by "Flight" Photographs

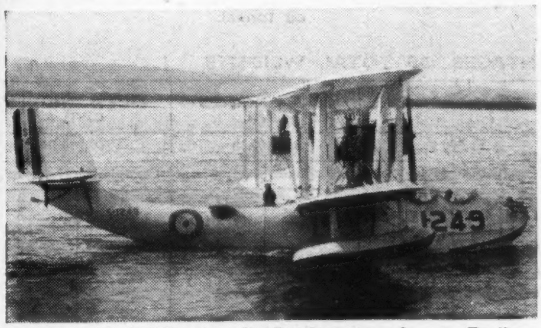
BY way of background to his lecture Mr. Knowler showed pictures of a number of flying-boats, from the Supermarine Southampton of 1926 to the Short Shetland and Martin Mars of recent times. He explained that since the hull of a flying-boat was required to plane, it must be of chine form and have a step, and the wing must be well clear of the water to keep engines and airscrews away from spray. Consequently, flying-boats were always of the high-wing type. The tail must also be set high for the same reason.

Contrary to general belief, Mr. Knowler said, the structure weight of flying-boats was similar to that of contemporary landplane counterparts. Wings, tail and power installations were about the same; the hull was slightly heavier than the fuselage of a landplane, but the outboard stabilizing floats were lighter than the landplane undercarriage. The table gives a weight percentage comparison between recent types of landplane and flying-boats of comparable size, and shows that the advantage is with the flying-boat. A curve was shown to indicate how percentage structure weight of flying-boats had decreased with size in the course of the years. The same reduction applied to landplanes except for the undercarriage, which might be expected to increase 2-4 per cent in 200,000 lb sizes. Increase in structure weight, Mr. Knowler said, was not likely to be the limiting factor on the ultimate size of flying-boats.

With increasing size there had been a tendency towards increased wing loadings and decreased power loadings, accompanied by a decrease in parasite drag by cleaning-up excrescences. Fig. 1 shows the profile drag of flying-boats of modern design plotted against all-up weight. To make the results comparable, the ordinate used was the drag at zero lift divided by the all-up weight. The reduction in drag with increasing size followed from a reduction in relative body drag due to smaller relative surface area; reduction in relative wing drag; slight reduction in skin friction and drag coefficients due to increase in Reynolds Number; reduced specific power-plant drag with increasing engine power; and finally it was easier, the larger the aircraft, to suppress the parasite drag of excrescences, air leaks, gaps, etc. There was an interesting relationship between weight and drag in this comparison. If the structure weight of a flying-boat was 3 per cent less than that of a similar landplane, then the hull drag could be about 20 per cent greater than that of the fuselage and, with equal performance, the all-up weight of the flying-boat could be 5 per cent less.



The Short/Saro Shetland on the River Medway. This flying boat was accidently burnt at its moorings.



The metal hulled Supermarine Southampton of 1927. Earlier models had wooden hulls.

Shape affects Drag

In the past, hull drag had been larger than the drag of a fuselage mainly because the hull size had been dictated by buoyancy considerations rather than by the load to be carried. With increase in size this difference was disappearing. The greater drag of a hull due to shape was caused by the sweeping-up of the aft portion, the steps, and the chines. The worst offender was the main step, and Fig. 2 shows attempts to improve matters. It illustrates models tested in the compressed-air tunnel at the N.P.L., the drag figures representing aircraft weighing 150,000 lb at 100 ft/sec. Mr. Knowler's comments on the different shapes were as follows:

"The conventional step E, in general use until recently, is about 9 per cent of the beam in depth, and is V-shaped, in plan view, at an angle of 20-30 deg. This shows a 50 per cent increase in drag over the faired fuselage shape A.

"The faired step D is an improvement on step E and is now generally used, but it has sometimes a tendency to cause instability on the water.

"Step C, which is streamlined in plan view, and is also faired in profile, has had considerable tank testing, and is likely to come into general use shortly, as it has good high-speed stability characteristics on the water as well as a fairly low drag.

"The retracting step B, although it has the lowest drag, has not found much favour so far, due to its complication, vulnerability, and weight."

Mr. Knowler then referred to a method of reducing step drag which is now being tested on a small Saunders-Roe

FLYING-BOATS

machine. No step is used, but air is blown out at appropriate positions along the hull bottom, thus destroying the suction of the aft planing bottom. The experiment was proving successful and the method would require investigation for application to future machines.

The two primary design parameters are wing loading and power loading. Mr. Knowler dealt with this subject in considerable detail. Curves were given showing the effect of wing and power loading on take-off run, and it was pointed out that for a given run there can be an interchange of these loadings. For a 1,500 yards run, for example, the wing and power loadings could be 40 and 13.5; 60 and 11; and 80 and 8. (The combined loadings are a good deal higher than is customary for landplanes They work out at 540, 660 and 640 respectively. ED.)

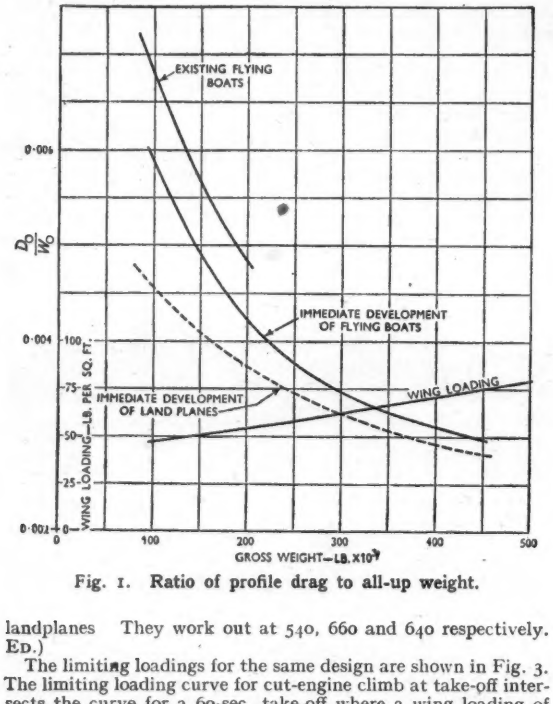
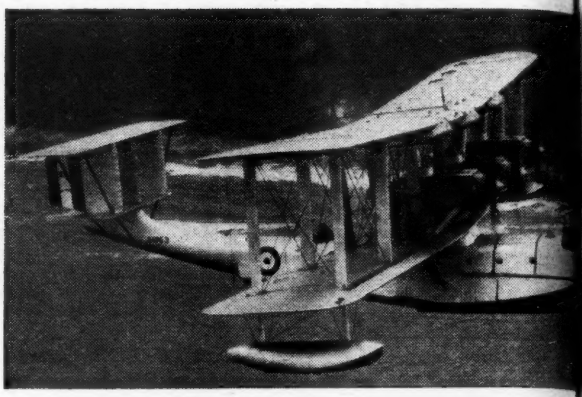


Fig. 1. Ratio of profile drag to all-up weight.

The limiting loadings for the same design are shown in Fig. 3. The limiting loading curve for cut-engine climb at take-off intersects the curve for a 60-sec. take-off where a wing loading of 56 lb/sq ft is used with a power loading of about 12.5. If these two conditions must be met, the optimum loading for high-speed, high-altitude cruising is not quite satisfied.

Effect of payload and range requirements on design size is illustrated in Fig. 4. There is some benefit from using jet propulsion for short ranges, but the excessive fuel consumption nullifies this for the longer ranges. Transport efficiency, as measured by the ratio of ton-miles to all-up weight, also varies with range and size. Optimum for a 100,000 lb machine is a ratio of about 0.18 for a range of 3,000 miles. For a 300,000 lb machine the figures are 0.23 and 3,600 miles.

Next Mr. Knowler dealt at considerable length with the hydrodynamic and structural design of flying-boats. Unfortunately, we have not space enough to report this part of the lecture. On the subject of pressurization the lecturer said the simplest form of hull was obviously a cylinder with the planing bottom built on. The two-deck arrangement (see Fig. 5) was



Blackburn Iris V of 1931 flying over Devon coast.

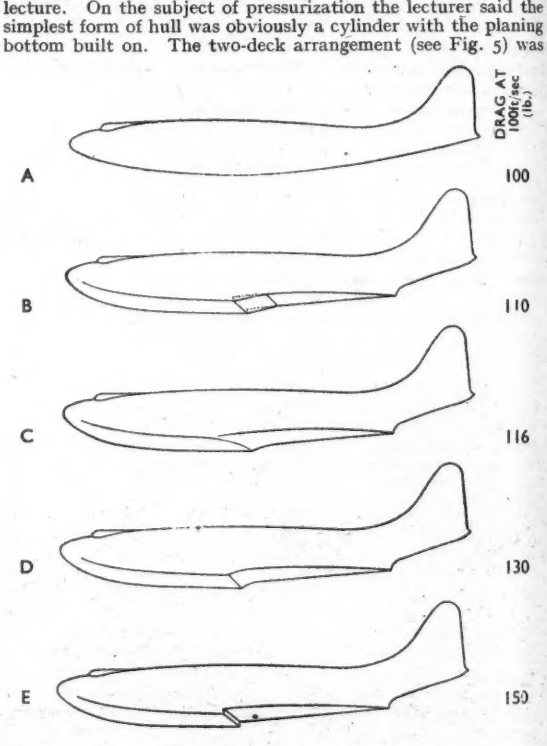
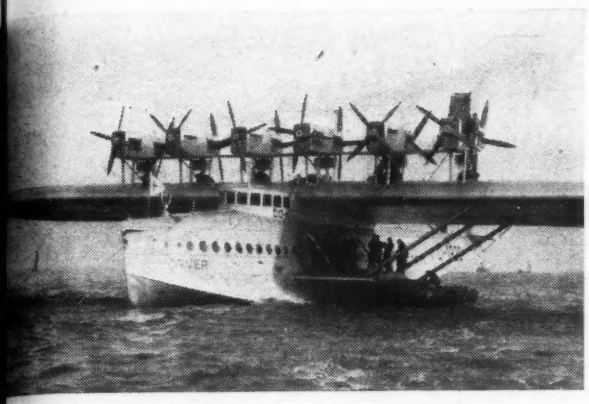


Fig. 2. Flying-boat hull drag. Models tested in compressed-air tunnel.

LOAD AND STRUCTURE PERCENTAGES OF TOTAL WEIGHTS

TYPE OF AIRCRAFT	TWO-JET FIGHTER		TWO-ENGINED MILITARY		FOUR-ENGINED MILITARY		FOUR-ENGINED CIVIL		MULTI-ENGINED CIVIL	
Gross weight	15,000 lb		35,000 lb		55,000 lb		150,000 lb		300,000 lb	
Aircraft type	Landplane	Flying-boat	Landplane	Flying-boat	Landplane	Flying-boat	Landplane	Flying-boat	Landplane	Flying-boat
Body	7.7	11.7	9.0	11.8	7.3	11.7	8.7	12.0	9.0	11.3
Wings	13.5	15.9	10.1	12.2	11.4	12.1	12.5	13.0	16.5	16.5
Tail	3.1	3.1	1.6	1.8	1.3	1.9	1.5	1.8	1.6	1.7
Chassis or floats	5.9	1.65	3.4	1.5	5.2	0.9	5.6	1.1	5.4	1.2
Remainder	6.2	1.05	3.6	1.6	3.8	1.9	3.5	1.9	1.6	1.0
Structure	36.4	33.4	27.7	28.9	29.0	28.5	31.9	29.8	34.1	31.7
Power plant	23.7	28.05	20.9	22.6	23.6	18.5	17.5	18.0	15.5	16.0
Load	39.9	38.55	51.4	48.5	47.4	53.0	50.6	52.2	50.4	52.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100·0



The Dornier Do X moored off Calshot Spit in 1931.

possible if the upper deck was placed at the intersection of the two circles. A third method was used in the Saunders-Roe civil boat. In this case the lower deck is used to carry the internal pressure. This might appear to be a heavy arrangement, but by using the strong planing bottom structure to reinforce the deck, little additional weight was required to withstand the internal pressure. This deck also formed a valuable horizontal watertight bulkhead.

On the subject of power plants for flying-boats, Mr. Knowler said the piston engine, for best economy, must be operated on a weak mixture at medium boost and medium speed. The airscrew-turbine, on the other hand, showed its best specific consumption at full throttle, high altitude, and high speed. The best altitude was governed by the power and wing loadings. The lowest consumption, and nearly the maximum speed, was obtained at an altitude such that flight took place at just over the speed representing maximum L/D for the machine when operating at the maximum permissible power for cruising. This altitude would be from 30,000 to 40,000ft. The airscrew-turbine had many advantages for long-range transport. Over-weather flight above icing conditions justified a high altitude, and high journey speeds and a high transport efficiency were obtained compared with the piston engine at the same heights.

The problems of maintenance and docking were dealt with next. An outline was given of a type of dock in which the passengers could embark and disembark under cover, the boat being serviced from the opposite side in the meantime. The roof provided a convenient support for lifting tackle. The Saro automatic mooring scheme already described in *Flight* was mentioned briefly.

Mr. Knowler concluded his lecture with some interesting facts about the new Saunders-Roe SR.45, from which we quote the following:

"The machine is required for the direct Trans-Atlantic flight

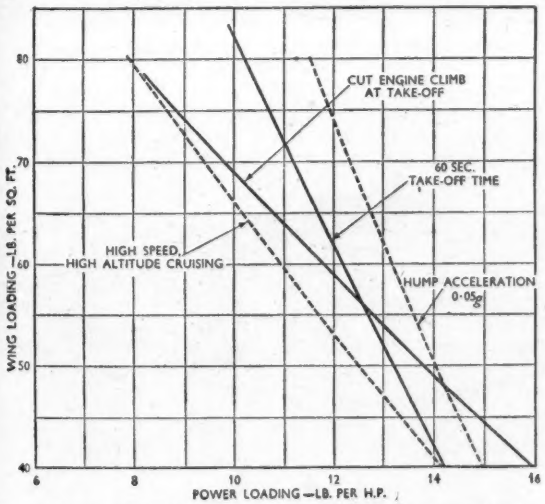


Fig. 3. Limiting wing loading versus power loading.

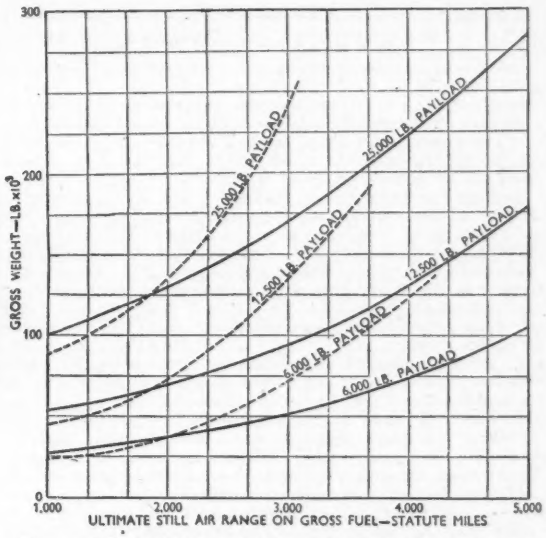


Fig. 4. Effect of range and payload, with high standard of passenger comfort, on design size of aircraft. Airscrew-driven aircraft shown in full line, jet-propelled dotted.

from England to New York. This is probably the worst route in the world, not so much because of the distance, which is 3,450 miles, but because of the very high adverse winds which blow from the west throughout the year. For instance, on the outward journey, flying at 35,000 feet, in order to maintain an 85 per cent frequency of service during the winter months, allowance must be made for head winds up to 80 m.p.h. over the whole journey; moreover, icing conditions are frequent in winter, and low visibility is common at the terminal bases. To meet these adverse winds, and to cover route diversions and other allowances, a still air range of 5,000 miles is necessary.

"A high cruising speed is specified. To obtain this, and to provide overweather flying, the flying boat will operate at from 35,000 to 39,000 feet altitude, at a speed of over 350 m.p.h. The weight of the machine at take-off is 290,000 lb, carrying 84 passengers and 3,000 lb of mail. The power required for take-off is 30,000 h.p., which will be supplied by six propeller turbines.

The Pressurized Hull

"The hull is pressurized to a working pressure of 8 lb per sq in. The cross-section consists of two intersecting cylinders with an upper deck at the junction, and a pressurized lower deck cutting the bottom cylinder, which is supported against internal pressure loads by the planing bottom frames and structure. This form of hull is very suitable for a flying-boat, as the required floor area is obtained on a relatively deep body, which has the advantage of raising the wing and propellers well above the normal spray height.

"The body is developed from two cylinders, the upper 11ft 3in in diameter and the lower 14ft 6in in diameter. It is parallel for 45 per cent of the hull length on the upper deck, and 60 per cent on the lower. The overall dimensions of the hull are: length overall, 147 feet; main and aft planing bottoms, 63 feet and 56 feet respectively; and the maximum beam 16ft 6in.

"The weight of the wings, when on the water—about 80 tons—is distributed fore and aft to two main frames, and is carried

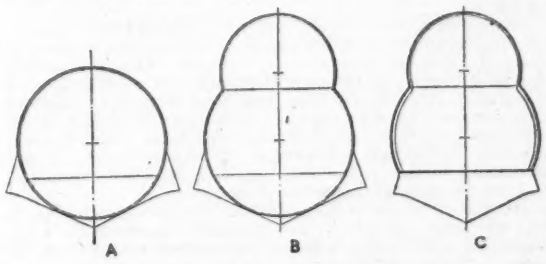


Fig. 5. Pressurized hull forms.

FLYING BOATS

through to the rest of the structure without use of bulkheads, a clear space is thus provided throughout the lower deck.

"The pressurized part of the hull extends nearly the whole length, but the part intersected by the wing and the bow compartment in the lower deck, is outside the pressure region. Great care is necessary to make the joints in the plating, as well as all doors and openings, as airtight as possible, since with such a large volume an accumulation of minor defects may prevent the building-up of the pressure as required. The pressure supply is completely duplicated. It is pumped by two-stage centrifugal blowers driven off the main turbines. Each blower is capable of supplying 1,500 cu ft of air per min at 8 lb per sq in pressure from an ambient pressure of 3 lb per sq in and a temperature of −70 deg F at an altitude of 39,000 feet. This air is conditioned before delivery into the hull to a temperature of about +70 deg F and 40 per cent humidity. As the ambient humidity at great heights is negligible, a considerable weight of water must be carried for this purpose.

"When used on tropical runs, a refrigerator and dehumidifier are added; this plant works on the air-cycle system. The air from the main compressor is cooled and passed through a free-running coupled compressor and expansion turbine, and a second stage of cooling is interposed between the second compressor and the turbine. The energy lost in driving the turbine is expressed by a considerable drop in temperature.'

Finally, Mr. Knowler expressed the view that the development of flying-boats, apart from increased size, would be in the direction of long, narrow hulls, perhaps without steps and with but rudimentary chines. The wing would have low aspect ratio, be thin and heavily tapered and with a heavy sweep-back. This aircraft, of the not-far-distant future, would be propelled by axial-flow jet turbines, but some form of augmentation of power would be used for take-off and initial climb. It would be necessary to fly this machine at a considerable height, probably about 50,000ft, and a speed of 500 m.p.h. was likely to be developed.

The Second Lecture

Mr. Masefield began his lecture to the Institute of the Aeronautical Sciences by saying that, without wishing to be considered a passionate advocate of the flying-boat in any circumstances, his personal opinion was that the flying-boat has a future, a great future, in a specialist category of air transport. Two cardinal points had to be answered: the commercial demand for large aircraft, and the provision of adequate marine bases. The large landplane and the large flying-boat were not necessarily antagonistic; there appeared to be room for both.

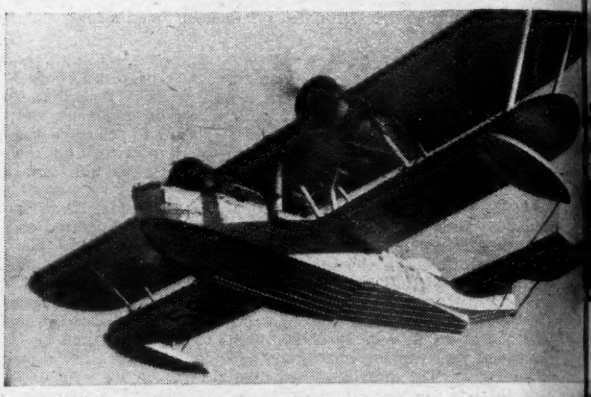
Three questions had to be settled before one could decide whether or not the flying-boat has a commercial future as compared with the landplane: Could it be made as fast on equal power? Could it be made to carry the same or better payload for a given range, power for power? Could it be maintained and operated for the same cost at the same intensity of operation? Mr Masefield catalogued nine very common criticisms of the flying-boat, and showed that five of them could be eliminated by the use of a proper marine airport and by the automatic mooring and docking scheme evolved by Saunders-Roe

An examination was made of two hypothetical designs, one a landplane and the other a flying-boat, both of 200,000 lb. gross weight and both fitted with airscrew-turbine engines. The disposable load of the landplane worked out at 82,000 lb., that of the flying-boat at 87 000 lb. With the landplane cruising at 400 m.p.h. and the flying-boat at 385 m.p.h., both at 30,000ft., the former would have a payload, on the London-New York route, of 13,500 lb compared with the flying-boat's 16,500 lb,

Having decided that basically the large flying-boat is capable of competing with the landplane, the next step was to examine the probable cost of a proper marine base. The requirements were laid down, and the estimated cost of an enclosed lagoon three miles long and 1½ miles wide, with a depth of water of 15ft., worked out at £3,825,000 This figure included terminal buildings, slipways, hangars and workshops, etc., but not the cost of the land. A comparable airport for the largest landplanes would cost at least £25,000,000. Maintenance of the two would be in proportion to first cost.

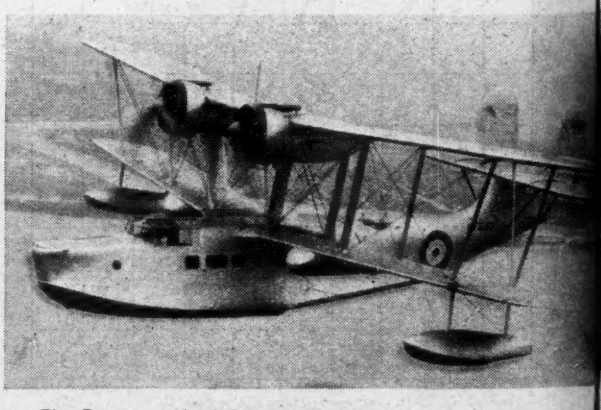
Having made the comparison between the large landplane and the large flying-boat, Mr. Masefield examined the arguments for and against large aircraft in general (100 tons or more, carrying 100 passengers or more for the longest ocean flights). Against large aircraft might be put: a big capital

Unaccountably named Southampton X, this Supermarine bore little resemblance to earlier Southamptons.

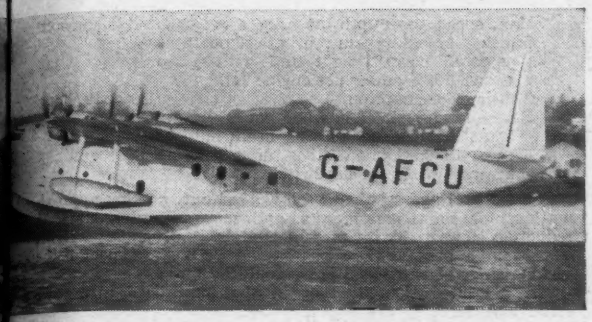


A sturdy boat designed for the R.A.F.—the Saunders-Roe London (2 Pegasus) went into service in 1936.

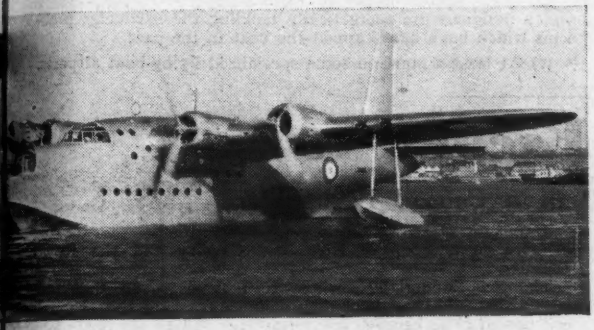
The Sikorsky S-42 Clipper of 1933 which was powered by Hornet engines.



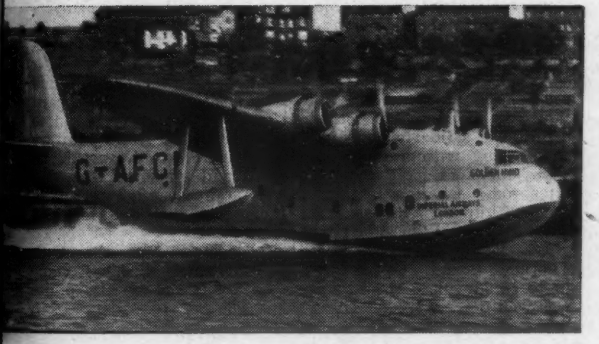
The Pegasus-engined Supermarine Stranraer, first flown in 1935.



Perhaps the most successful commercial flying boat yet built, the Short "C" class, of 1936.



A development of the "C" class, the military Short Sunderland, was first flown in 1938.



Three of the 1939 Short "G" class boats (four Hercules) were built and were intended for the North Atlantic run.

High performance was sought by Saunders-Roe in designing the twin-Hercules Lerwick, the prototype of which appeared in 1939.

outlay; traffic problems of handling many passengers at terminals simultaneously; in case of accident it represented a heavy loss and a major personnel catastrophe. Insurance was a big item; large aircraft meant less frequency of operation.

On the other side there were, in the lecturer's opinion, equal or even more cogent arguments in favour of large aircraft. The capital outlay was large, but he estimated that, operating at an intensity of 3,000 hours a year, the annual earning capacity of a large boat would be about twice the first cost. At a reasonable margin of profit it should pay for itself nearly twice, over a five-year life, after working-off all operating costs and overheads. Terminal handling of passengers should be possible, with a speeding-up of customs, immigration and health processes.

As for the catastrophic nature of a crash, Mr. Masefield thought the chances were less for a boat than for a landplane. There would be less congestion at the marine airport, and the fire risk after a crash was smaller than with a landplane.

Frequency of operation was one of the most complex issues in commercial aviation. "Small and often" used to be the slogan, but on many routes to-day it was a question of "large and often." Saturation at airports set a limit, and with jet aircraft we should not be able to afford to spend time being "stacked-up" waiting for a landing turn. Consumption figures would not allow it.

An interesting sidelight on the trend towards larger units was the fact that, with an average flight time of ten hours across the Atlantic, there were only 13 hours during which departure and arrival could be timed to avoid leaving or arriving between the hours of midnight and 6 a.m.

From the economic point of view, large aircraft scored both aerodynamically and in operating costs. For still-air ranges of 4,500 miles and upwards large aircraft became a necessity, and in really large sizes the advantages of the boat must be admitted. The new Saunders-Roe flying-boat of nearly 300,000 lb. weight, with a span of 220ft, an area of 4,800 sq ft, and driven by 12 Rolls-Royce airscrew-turbines in six coupled pairs, would have a still-air range of 5,000 miles, cruising at 365 m.p.h. at 37,000ft while carrying 100 passengers at a lower direct operating cost than any contemporary known type. It was designed to fly between the London area and New York in direct flight against a continuous headwind of 60 m.p.h.

The type of operation most suitable for boats of this sort had yet to be worked out. Some obvious traffic peaks which could be relieved were the summer traffic across the North Atlantic, and the heavy Christmas mail and passenger traffic between England, Australia and New Zealand. As an example of how a month of operation might possibly be planned Mr. Masefield gave the following table:

Days	Journey	Mileage	Flying Time
1st and 2nd ..	London—New York ..	3,500	12 hr.
2nd and 3rd ..	New York—London ..	3,500	10 hr.
4th	London—Cairo	2,200	7 hr.
5th	Cairo—Cape Town ..	4,500	15 hr.
6th	Cape Town—Cairo ..	4,500	15 hr.
7th	Cairo—London	2,200	7 hr.
9th and 10th ..	London — Bermuda — Jamaica	4,000	14 hr.
11th and 12th ..	Jamaica — Bermuda — London	4,000	14 hr.
14th and 15th ..	London—New York ..	3,500	12 hr.
16th and 17th ..	New York—London ..	3,500	10 hr.
18th to 20th ..	London — Sydney, via Karachi and Singapore	11,500	40 hr.
21st	Sydney — Wellington ..	1,400	5 hr.
22nd	Wellington—Sydney ..	1,400	5 hr.
23rd to 25th ..	Sydney—London ..	11,500	40 hr.
26th to 28th ..	London—Cape Town ..	6,700	21 hr.
29th to 31st ..	Cape Town—London ..	6,700	21 hr.

Total for one month's operations 74,600 miles in 248 hours.

With three Saro SR-45 boats such a schedule could be covered twice a month, leaving additional utilization available for a monthly round-the-world cruise calling at all the chief traffic centres. Bases would be necessary, but he thought the world routes could be equipped for a total of £60,000,000. Obviously three SR-45 flying-boats were not going to make a dozen marine bases into an economic proposition, but if they realized expectations, other big boats and other marine bases would follow. Moreover, the gas turbine might modify the argument that the flying-boat is economic in large sizes only.

Mr. Masefield then drew on some original work done by Marcus Langley and Hessell Tiltman, dealing with the jet-

FLYING BOATS

propelled, medium-size flying boat. By using ducted-fan turbine units the wing could be brought much lower without water and spray entering the intakes. By using non-volatile fuel the tanks could be placed in the double bottom of the hull, thus lowering the centre of gravity. The result was that smaller outboard stabilizing floats could be used, and the hull could have a smaller cross-section, thus avoiding excessive hull drag in a medium-size boat.

Based on these ideas, a jet-propelled 50-ton flying-boat had been designed which, although only 40 per cent of the size of the Saro design, compared well with equivalent landplanes. The leading particulars of the Langley-Tiltman three-stage ducted-fan flying-boats are:

Length	106ft.
Wing span	142ft.
Wing area	2,000 sq ft.
Tare weight	60,455 lb.
Disposable load	54,545 lb.
Gross weight	115,000 lb.
Max. speed 500 m.p.h. at	36,000ft.
Cruising speed 445 m.p.h. at 36,000ft at 95,000lb mean weight and with 3,250 thrust horse power per engine (2).	
Cruising consumption	4,920 lb/hour.
Payload 24,845lb for 2,000 miles in 5.2 hours against 40 m.p.h. headwind, or 13,045lb for 3,000 miles in 7.4 hours against 40 m.p.h. headwind.	

Some operating costs had been worked out, making approximations for maintenance costs, and they showed a startling reduction compared with present landplanes of similar weight. The example showed the sort of thing we might expect if the vicious circle of boats and bases could be broken.

Mr. Masefield thought that in the immediate future we could look for:

(a) A new type of 300,000lb flying-boat now under construction and likely to be ready for service by 1951.

(b) Some smaller types of turbine-powered flying-boats in which designers are energetically tackling the particular problems which have handicapped the boat in the past.

(c) At least a start on some specialized flying-boat airports.

Royal Escort

Over "H.M.S. Vanguard" in a Coastal Beaufighter

AT 7.30 a.m. last Saturday Thorney Island lay deep in snow and mist and S/L. Lumsden, of No. 42 Squadron, had doubts if his Beaufighters would be able, as planned, to escort the Royal Family in H.M.S. *Vanguard*. At that hour the great ship had already sailed from nearby Portsmouth on her South African voyage. Fighter Command had notified their inability to escort her for the first hour of her trip and the historic departure was thus deprived of Mosquito, Hornet, Spitfire, Vampire and Meteor formations totalling 54 aircraft.

The fighter units being grounded, it was obvious that "Coastal" would operate the aircraft detailed for the second phase of the escort if this were humanly possible. These were four Beaufighters of 42 Squadron, four Mosquitoes of 36 Squadron (both units based at Thorney Island) and two Sunderlands of 230 and 201 Squadrons, acting as photographic and Air-Sea Rescue aircraft.

Breakfast over, S/L. Lumsden confirmed that the Thorney formations would fly. The runway and taxi tracks had been cleared of snow on the previous afternoon and clearing was again in progress.

We found the four Beaufighters outside their hangars, from which it had been possible to extricate them only by salting the deep snow. A Balaclava-ed and vapour-breathing figure helped us up through the hatch of "P" for Peter, in which F/L. Stansfield and his navigator, W/O. Hall, were already installed.

The Squadron Leader's Beaufighter kicked back clouds of snow as we taxied out behind it. Our own machine lifted smartly from the glassy runway and by 9.20 the four "Beaus" were picking up a tight formation—a Vic of three, with the fourth man "in the box." The Mosquitoes, similarly disposed, and led by W/C. Hoggarth, followed a mile astern and we headed out past the Isle of Wight, showing as a delicate tracery of hedgerows on a sheet of white.

Found and Fixed

About 15 miles past the Nab, on a course of 210 deg, W/O. Hall picked up *Vanguard* and her attendant ships on the A.S.V. Forewarned over the intercom., we soon spotted the battleship, though her wake was less noticeable than that of the five escorting destroyers.

At this time there was nothing particularly impressive about the scene, but as we flew circles of about two miles radius round the little armada, the wintry sun came slanting through heavy clouds, catching the *Vanguard* and throwing the light-grey monster into bold relief.

Having been ordered not to approach within a mile and a half of the Royal ship, it was irritating to see one, and later, a second civil-registered Rapide pass the vessel within a few hundred yards. Presumably the Notice to Airmen prohibiting close flying near the Royal vessel was applicable only inside territorial waters. One tried to visualize a newsreel van cutting in between a troop of Household Cavalry and the Royal Daimler.

The two Sunderlands, whose R/T messages to and from Group we could hear, kept their distance from the ship, though one passed close beneath our formation. These big boats lent great dignity to the scene.

For the best part of an hour we circled at 190 knots in tight formation, grazing the edges of dense-looking clouds. The five ships maintained impeccable formation until the destroyers drew ahead and broke away. On the turn, the bow wave of the outside ship increased greatly in size, evoking the "inter-comment" that the Owner had her "through the gate."

At 10.33 we turned for base and S/L. Lumsden ordered the Beaufighter in the box to take up position on our starboard side. As we approached the Isle of Wight visibility began to deteriorate seriously and it was comforting to think that we were flying with a Coastal Command crew. Nevertheless, snow, incipient icing and very low cloud made us thankful, after some sobering moments, when our Beaufighter finally touched down. Brakes were ineffective and one machine became temporarily snowbound.

We were in S/L. Lumsden's office when the O.C. Thorney Island, G/C. C. McK. Grierson, C.B.E., came in to congratulate the formation on a fine show. His praise was well deserved.

THE LYNEHAM REUNION

ON Saturday last over 80 members of aircrew, including S/L. J. F. (Baggy) Sach, D.F.C., A.F.C., who recently flew Field Marshal Montgomery to Moscow, coming from all parts of the globe, foregathered at the Chandos Restaurant in London to meet old friends who had served at Lyneham from 1942 to 1946. A few "satisfied customers" were also present, including Percy Rogers, C.B.E., late of the Ministry of War Transport, who put in 1,500 flying hours with Transport Command. It was a joy to hear him describe a wartime journey to Stockholm in the bomb bay of a Mosquito. His gestures when describing the action to be taken should a jump have become necessary were lovely to behold.

Padre Rees proposed the toast of the King and of the guest of honour, A. Cdre. Fressanges. G/C. Pickard O.B.E., president of the Lyneham Association (who led the air lift to Yalta) said he hoped to see three or four such meetings held each year, including a Ladies' Night in April.

Flt/O. Luck (Lucky) asked whether W.A.A.F. types would be allowed at stag parties and was informed than W.A.A.F. and ex-W.A.A.F. officers were stags.

To help make the Lyneham Association a success a card index of members' names and telephone numbers is being compiled so that, on ringing the secretary, W/C. T. A. S. Harpham, at Waterloo 4401, members visiting or at a loose end in London, would be sure of being able to contact one or other of their old mates.

Science is Measurement

Sensitive Altimeters Ranged to 70,000ft : True Air Speed Indicators for Cabins

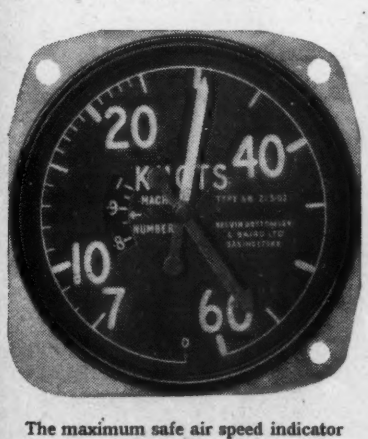
THE title of this article was a favourite dictum of Lord Kelvin, pre-eminent scientist in his day and one of the greatest scientific figures of all time. This great man founded the now famous firm of Kelvin, Bottomley and Baird, and on a recent visit to their Basingstoke factory we were able to see that the postulates laid down by the founder are still a live force to-day.

Of all forms of progression, flying necessitates perhaps a wider use of, and greater reliance on, instrumentation than any other. Not only is the modern aircraft equipped with a veritable host of instruments, but the organization of aviation—flying control and so on—is based to a large extent on the portrayal of conditions by means of instruments.

Kelvin, Bottomley and Baird's model factory at Basingstoke was opened in 1936 as the company's specific home of aircraft instrumentation, and during the war it achieved the notable output of well over half a million aircraft instruments of all types, in addition to repairing and returning to service somewhat over 100,000 further instruments.

When thinking of such instruments as altimeters, engine-speed indicators and air speed indicators, one is very much apt to take them for granted. They have, so to speak, been with us for so long and are thus not accorded the glamour which attaches to newer and, perhaps, more colourful devices. It is, however, instructive to review their development. Originally the sensitive altimeter had an upper limit of 20,000ft, and then this was increased to 35,000ft and, subsequently, to 50,000ft. They are now obtainable ranged up to 70,000ft, and, with this, are accurate to within a tolerance error of less than one per cent whilst operating at temperatures of −40 to +50 deg C.

Engine-speed indicators have also had quite a considerable degree of development. At first the common range of E.S.I. calibration was up to 3,500 and 5,000 r.p.m., but the advent of gas turbines has necessitated instruments ranged up to 20,000 r.p.m. A further development was brought about by the wider use of multi-engined aircraft coupled with the need to keep intrument panels as compact as possible. Thus was born the dual E.S.I., which indicates on one dial the speed of two engines—and also shows when the engines are running synchronously. This basic instrument in a suitably modified form is also being used on helicopters to indicate engine and rotor speeds.



The maximum safe air speed indicator showing red limit pointer, Mach number setting scale and ordinary air-speed pointer.

Safe I.A.S.

As with other instruments, air speed indicators have also had their operating range markedly increased; at first a maximum speed of 160 m.p.h. was the limit, but A.S.I.s are now available calibrated up to 700 m.p.h. A new development to the standard A.S.I. embraces indication by a second, red, pointer of the limiting safe speed of the aircraft at whatever height the machine may be flying. The maximum safe speed at which the particular aircraft can be flown is pre-set, in terms of Mach number, on the instrument, and so long as the normal air speed pointer is kept below the figure indicated by the limiting red pointer, the safe speed will not be exceeded. This instrument should be a great boon to pilots of all high-speed aircraft; its development is most timely.

Another variant of the ordinary A.S.I. has been produced as a cabin fitting for passenger aircraft. Since it is intended for laymen, true air speed is required, for it is patently useless to give indicated air speed and then tell passengers that such-and-such a correction is required as the aircraft is flying at, say, 15,000ft. The cabin indicator is, therefore, equipped with automatic correction for atmospheric density and also includes correction for temperature based on I.C.A.N. conditions. It is unlikely that the factual conditions encountered on any one day will accurately match the I.C.A.N. standard; however, as an overall case, the cabin indicator should register a speed within about 3 to 5 per cent of the actual true air speed, and that is quite faithful enough for such a purpose. These instruments are, incidentally, fitted in the staterooms of the King's Flight Viking aircraft which are to be used on the Royal Tour.

Machmeters are air speed indicators, in their peculiar way, but they are not of very much use to the ordinary pilot: they are essentially test instruments, and very important instruments, too. The K.B.B. machmeters developed for the D.H. 108 (although, of course, applicable to any other aircraft) have a range of from 0.3 to 1.0 Mn over an altitude range of 0 to 50,000ft and are accurate throughout the operational range to a standard of 0.01 Mn.

During the war a device was evolved at Farnborough which effected a marked reduction in the number of bombers which were lost. Called the Air Mileage Unit it was given to Kelvin, Bottomley and Baird to develop, and it is now used on civil airliners to record, as a check on fuel consumption, the number of miles flown. In brief, the principle of operation is that a fan air pressure equivalent to the pitot pressure causes an output shaft to rotate at a speed proportional to the true air speed.

A maximum safe air speed indicator being calibrated against reference sub-standards.

Of all the devices shown to us at Basingstoke, perhaps the most intriguing and, certainly, one of the most important in its likely effect on future aviation, was the radio-sonde. This has been developed in collaboration with the British Meteorological Office and the Telecommunications Research Establishment in order to provide accurate information of upper air conditions. Slung from a parachute, in turn suspended from a balloon, the instrument is of chronometric type and contains meteorological elements for testing atmospheric pressure, temperature and humidity. Each element actuates an arm making contact with a rotating helix, and the time interval between each contact and a fixed reference contact gives a measure of the respective quantities tested. A signal is transmitted at each instant of contact by a radio transmitter attached to the chronometric unit, and is automatically recorded by a ground receiver and recorder. The recorder thus gives a continuous chart of the meteorological quantities throughout the flight of the sonde. Tracking by a radar ground station with an effective range of the order of 100 miles additionally supplies information as to velocities and directions of upper-air winds. This latest form of radio-sonde is said to be superior to any of the types now in use, and preliminary trials have demonstrated that it will enable accurate forecasts to be made about 36 hours ahead.

D

"Flight" photograph.

Britain's Test Pilots

No. 19

ARTHUR JOHN PEGG, M.B.E.

COINCIDENT with the publication of this story of A. J. Pegg's flying career comes the news, reported on page 147, that he has been appointed Chief Test-Pilot of Bristols. The company is to be congratulated on a very happy appointment in which we feel sure Pegg will very ably carry on the great tradition created by Capt. Cyril Uwins.

IT seems to be the fate of test pilots to be called by Christian names other than their own. By his many friends in the Service and the industry—and they are legion—Pegg is affectionately known as "Bill." The re-naming came about this wise—he and an elder brother always called each other "Bill" and both were in the Service together, and the name became accepted.

Pegg's first contact with things aeronautical came during the 1914-18 war, while he was living in Malta. His father, a captain in the R.A.O.C., was stationed on the island. One day a seaplane—probably a Short 225—made a forced landing in Sliema Bay, and Bill, a schoolboy of 10 years of age, swam out to lend a hand. Thrilled to the marrow by this experience, Bill decided that when he was old enough he would not follow his father's footsteps into the Army, but would go into the Royal Flying Corps.

Back in England after the war his wish was gratified, and he joined his brother at Cranwell for the third post-war three-year course on engineering. This, of course, was before Cranwell became the R.A.F. College, and the curriculum at that time was similar to that now laid down at Halton.

At the age of 18½ years he was posted from the school with the rank of L.A/C. to No. 9 Squadron, to service Vickers Vimys. This arrangement of posting youngsters direct from school with seniority—some were corporals—caused much heart-burning among the old sweats of the day. It was the first break with tradition in the matter of promotion, and a very wise move it has proved.

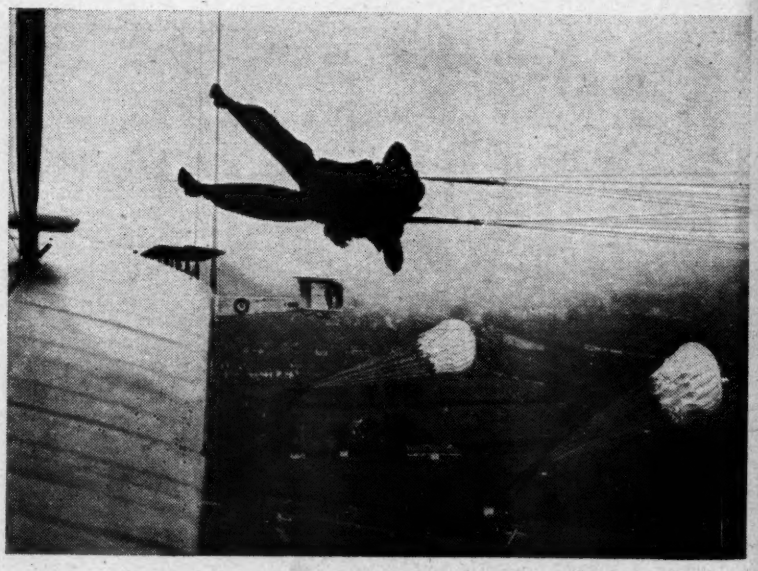
However, life with a tool kit did not satisfy John Pegg for very long, and when the sergeant-pilot scheme came in (hitherto all pilots had been commissioned) he made numerous applications to re-muster. At last his request was granted, and when he passed his final medical examination—the last test before being posted for flying training—he was so excited that he passed out completely on parade at Manston the following day. The next thing he remembers is sitting up in bed, and the effect was such that his memory had a complete two-day blank.

The training system of those days was different from that of to-day. *Ab initio* flying was carried out by the squadron to which an embryo pilot was posted. Usually two Avro 504s and an advanced trainer were available for this purpose. Pegg was posted to the famous No. 43 Squadron at Henlow, which then was equipped with Sopwith Snipes. F/O. Tommy Rose was his instructor.

At the controls of the prototype Wayfarer on a proving flight to the Channel Islands.

After 6hr 20min he went solo and then on to a two-seater Snipe, and finally was given his own single-seater Snipe. The Snipe with its Bentley rotary engine of 200 h.p. had a maximum speed of 125 m.p.h., the undercarriage had no damping, and it landed rather like a cat on hot bricks, and there was trouble with the gyroscopic effect of the engine causing an inverted spin off the top of a loop.

It was whilst Pegg was at No. 43 Squadron that the Parachute Circus visited Tangmere, and he made his first jump. It was an entirely voluntary business. The Circus had special Vickers Vimys with small platforms at the base of



How it was done. A pull-off from a Vickers Vimy. Other drops in later stages can be seen in the background.

the outboard rear interplane struts. The "droppee" stood on one of these platforms and clutched the strut. At a sign from the pilot the rip cord was operated and the canopy opened and pulled the body off, no matter how tightly one clutched the strut. Having got used to the sensation, other flights were usually made and free drops executed.

At Tangmere the pilots used to hold very unofficial sweepstakes to decide who could do the longest delayed drop. The tarmac would be full of pilots, all holding stop watches, and it is not surprising that the Air Council, in its wisdom, decided to stop the drops on account of the number of minor accidents. Pegg broke an ankle whilst trying to win a sweepstake.

In 1928 Bill was posted to C.F.S., at his own request, for an instructor's course, and having passed out as "above average," went to Sealand as an instructor flying two-seater Siskins.

"Flight" photograph.

Pegg's early favourite. The Bristol-engined Gloster Gamecock of 20 years ago. It is shown here being flown by H. J. Saint who was then Gloster's test pilot.

Cloud Flying

It will interest the present generation of pilots to learn that cloud flying was taught by Pegg and his fellow-instructors without any of the modern aids to blind flying. No artificial horizon, no gyro compass, no rate of climb or turn and bank indicator. All they had was a bubble-level, rev. counter, altimeter, airspeed indicator and the wind on their faces—mostly the wind on their faces.

Battle climbs through clouds were made by each aircraft of the formation taking a slightly divergent path as the cloud layer was entered, and then re-forming in the blue sky above. Whilst at Sealand he and Snaith, a one-time Schneider pilot, entered for the crazy-flying competition to decide which pair of instructors should fly for the event at the Royal Air Force Display, which was held each year. An honour much prized. Competitors were limited to single men only, and Pegg and Snaith became runners-up—they were turned down because they were too dangerous. Snaith used to roll an Avro Lynx at 0 ft.

After nearly two years at Sealand, Bill was posted back to C.F.S. in 1930, this time as a staff instructor with an A.1 certificate, but he was still a sergeant pilot drawing less than 10/- per diem. In July, 1931, however, he received the then very rare distinction of being awarded a permanent commission from the ranks (only two in the whole R.A.F. were granted that year), and he was posted to No. 22 Squadron, at the Armament and Aircraft Experimental Establishment, Martlesham Heath. This was the performance testing squadron, and it was here that Pegg started on his long and varied career as a test pilot. His flight commander was F/L. J. N. Boothman (now Air Vice-Marshal Boothman, C.B., D.F.C., A.F.C., Assistant Chief of Air Staff, Technical Requirements), and he flew such aircraft as the Hawker Hoopoe, Vickers C.O.W. gun fighter, Westland Wizard, D.H. Comet and A. W. Scimitar.

It was whilst he was doing terminal velocity dives on the prototype Avro Tutor at Martlesham that the wings came off and he had to make a jump for it. Having started at 10,000ft, he was doing about 250 m.p.h. at 3,000ft, and just taking his last reading, when the pair of wings on one side parted company. The fuselage and the remaining wings spun round and round like a sycamore seed, and Pegg, thrown about in the cockpit, and wearing flap mittens, had considerable difficulty in undoing his harness. When he eventually undid it he was thrown clear of the Tutor.

Now comes one of those curious mental efforts which occur only under conditions of great stress. Having had trouble in finding his harness release, he distinctly remembers debating with himself as he fell whether, because of time and the proximity of the ground, to attempt to pull the rip cord with his mittens on or to slip the flap back from his fingers first. Actually his self-disciplined test-pilot's mind came uppermost, and he remembers carefully removing the glove completely before pulling the rip. The chute opened at 1,000ft and a pair of wings narrowly missed him as they went by.

Descension

Dropping gently down into a field, he landed in front of a Suffolk farm labourer, who gazed at him with wide open eyes and backed away every time Pegg tried to get near him. Finally he took to his heels and ran, while Bill went up to the farmhouse to borrow a bike to get back to Martlesham. It was thought that the trouble with the Tutor was aileron flutter, which can, under certain circumstances, build up to danger point almost instantaneously.

During his spell at Martlesham Pegg handled a number of Bristol types, including the Bullpup, Bulldog R.5, the 120 with the first enclosed gun turret, and the Bombay troop carrier. In December, 1935, however, after much deliberation, he resigned his permanent commission and joined Papa Uwins on Bristols' own test-flying staff.

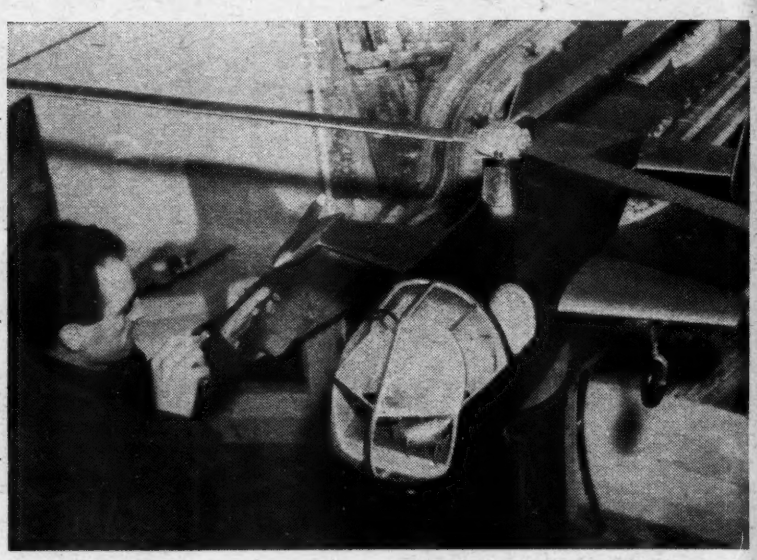
His immediate job was the development flying of the famous Bristol 142 "Britain First," which later developed into the Blenheim and was the first monoplane bomber to go into service with the Royal Air Force. Working as second dickey to such a hardy perennial as Cyril Uwins, who until this week insisted on doing all first flights of prototypes himself, has had its drawbacks. Pegg is in the peculiar position of having flown no fewer than 59 prototype aircraft (48 at Martlesham and 11 Bristol), and has yet to make a first flight. What usually has happened up to now is that Uwins did the first flight, then Uwins and Pegg did the early flights between them, until all basic controls were satisfactory. From then on Pegg carried out all the dives, climbs, speeds and other very necessary performance tests.

There are also other duties which he has to perform. For instance, in 1945 he went to India and flew a borrowed Beaufighter round all the squadrons. At each unit he gave lectures and cleared up any technical points requiring settlement. This is work that only a test pilot can do satisfactorily. In addition, pilots of foreign countries purchasing Bristol aircraft have to be instructed in their handling and maintenance, and civil types, such as the Wayfarer, must be demonstrated frequently.

Arthur John Pegg has 4,300 flying hours in his log books, on 130 different types. Over three-quarters of his flying time has been devoted to testing, and it was for his work as a test pilot that he was awarded the M.B.E. in the 1946 New Year Honours.

J. Y.

HERE AND THERE



WINGS TO COME : This model of the Fairey Gyrodyne found a place at the Shipwrights' Exhibition in London. Note the anti torque-reaction airscrew on the starboard stub-wing.

D.H. Distinction

IN recognition of his contribution to the progress of aviation, the U.S. Institute of Aeronautical Sciences has this year elected Sir Geoffrey de Havilland to an honorary fellowship.

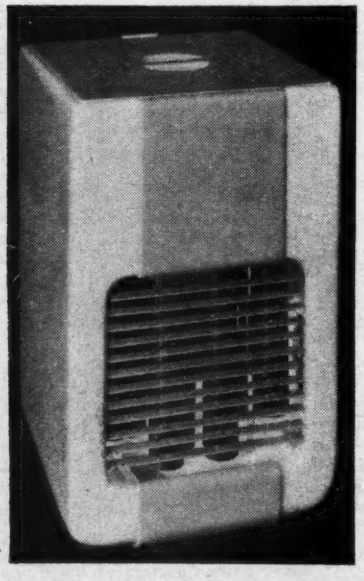
This a rare distinction which he shares with one other person, namely Mr. Frank W. Caldwell, director of research to the United Aircraft Corporation, who has received a number of awards for his work in airscrew development.

Britannia Trophy

THE committee of the Royal Aero Club has awarded the Britannia Challenge Trophy for 1946 to G/C. E. M. Donaldson, D.S.O., A.F.C., for his achievement in setting up a new World's Air Speed Record in the Meteor IV at 616 m.p.h. (991 km/hr) on September 7th last at Littlehampton.

This trophy (in case you don't remember) was presented in 1913 by Mr. Horatio Barber, pilot and designer of Valkyrie monoplanes in 1912, for the most meritorious performance in the air during the year by a British subject, and was first won (in 1913) by Capt. C. A. H. Longcroft, R.F.C., for a non-stop flight in a B.E.2. from Montrose to Portsmouth and back to Farnborough. This set up the first British long-distance record at 445 miles.

The holder for 1945 was G/C. H. J. Wilson who raised the speed record from 496 to 606 m.p.h. in a Gloster Meteor.



CABIN COOLER : The Artif-Ice cabin cooler unit showing outfit grill with cooler tubes behind.

Handley Page Appointment

MR. C. F. JOY has been appointed assistant chief designer to Handley Page, Ltd. It is an appointment which is effective from the beginning of this year.

Mr. C. F. Joy.

An Associate Fellow of the R.Ae.S., Mr. Joy joined the Handley Page company early in 1944 and has been connected largely with its new project activities, including the Hermes series.

Educated at the Coventry Technical College, Mr. Joy received his early training at Armstrong Whitworth, Ltd.

Cabin Cooling

A NEAT and small self-contained air-cooler unit produced by Artif-Ice, Ltd., is now available for passenger aircraft flying on such routes where cabin cooling is required. Essentially it consists of an insulated container for a supply of "Drikold" dry ice and a battery of heat-exchanger tubes below. A 24 v motor drives a fan behind the heat-exchanger tubes, the air drawn in thus being forced across the tubes, cooled, and redelivered to the cabin. The unit is approximately 18in tall x 9in x 9in, and is in peach-cream and blue enamel plastic material. (See adjoining picture.)

The Limit?

WE confess to being somewhat surprised at reading that Air Marshal Sir Milne Robb, A.O.C. Fighter Command, believes that we have reached the limit in speed—so surprised, in fact, that we almost expect to hear he was misreported on the point.

According to a news agency, however, Sir Milne expressed this opinion when speaking at an R.A.F. Association reunion at the British Legion Exhibition in Central Hall, Westminster, one evening last week.

This view, of course, is NOT shared by our most outstanding aircraft designers, aeronautical engineers and scientists.

Brabazon I's Interior

MR. RICHARD LONSDALE-HANDS, the British industrial designer, has been commissioned by the Bristol Aeroplane Company to design the interior of the Brabazon I for B.O.A.C., and will work in collaboration with Mr. A. E. Russell, F.R.Ae.S., the Bristol chief designer.

Over to You

THE London luncheon which marked the handing over of Britain's internal airlines to B.E.A. last week-end could hardly have been more genial, and this friendly atmosphere was set from the start by Mr. John Elliot, chairman of A.A.J.C., whose opening remarks, though brilliantly witty, paid just tribute to the pioneer concerns which built up the inland services.

Sir Harold Hartley, B.E.A.'s chairman, said their war record, of which they could be proud, was due in the last resort to the pilots, and he quoted 7,000,000 aircraft miles carrying over 300,000 passengers and 7,000,000lb of mail and freight without loss of life except for one machine shot down over the Scillies.

No Hard Feelings

WE have often heard how French people, living in the vicinity of enemy targets during the years of occupation, afterwards praised the R.A.F. for the way they pin-pointed Nazi establishments and bombed them with minimum ill-effect on their unwilling hosts.

But a recent Air Ministry *News Letter* reproduces an invitation received by the R.A.F. to attend the reopening of a Dutch business which was partially destroyed during an R.A.F. raid on adjacent railway yards at Utrecht when

HERE AND THERE

one box of bombs overshot the target.

As the business in question was a pawnshop, it was not only the proprietor who must have suffered considerable inconvenience from this unlucky "near miss," and the kindly invitation was just one more example of Allied understanding.

Over to Oil

THE shortage of coal in this country—a shortage which is now causing a number of factories to close down for part of each week with the resultant loss of production and hardship to employees—has been countered at the de Havilland plant at Hatfield by a partial conversion to oil fuel which saved 213 tons of coal during the first ten days of operation. Since then a second boiler has been converted to oil fuel with further great saving in "black diamonds."

One of the biggest difficulties that had to be overcome in effecting the conversion was to obtain suitable storage tanks, but a lucky contact led to the discovery of two 12,000-gallon tanks built for towing across the Channel for the Normandy operations but superseded by Pluto before they were ready.

While the D.H. concern is to be congratulated on its foresight and enterprise, it is a sad reflection on this country's management that, at a time when we are on the verge of national insolvency, an industrial concern of such importance should have to use imported fuel in a land which is almost built on coal!

PILOTS' PAINTINGS. One of the fine murals done by artists among the Australian aircrew who occupied the Hotel Metropole, Brighton (soon to be reopened), during training.

ANTIPODEAN ARRIVAL.—Sir John Buchanan, C.B.E., F.R.Ae.S., technical director of Short Brothers, and Mr. W. Hambrook (right) chief project engineer of Shorts, as they left the R.M.A. *New Zealand* at Auckland, N.Z.

News in Brief

A RECORD cargo of gold worth about 3,000,000 dollars (£750,000) arrived at a New York airport recently from the Bank of Canada for reshipment to Mexico.

* * *

Congratulations to Miss Jacqueline North, elder daughter of Mr. J. D. North, Boulton Paul's joint managing director, and Mrs. North; and to her bridegroom, Mr. Harry H. Noble, of Norwich. They were married in Bridgnorth (Shropshire) last Thursday and after their honeymoon will be going to Nigeria, where Mr. Noble is engaged in the Colonial Administrative Service.

* * *

R.T.P. models of the Vampire and the Sandringham, demonstrated at the third National Model Aircraft Exhibition held in Dorland Hall, Lower Regent Street, London, during January, are featured in a film of the exhibition made by *Pathé Pictorial*.

* * *

Another firm to adopt the five-day week system in its factory is Titanine, Ltd., of Colindale, London, N.W.9, the well-known makers of aircraft finishes, and these works are now closed on Saturdays.

* * *

Mr. Alan P. Good has resigned from the board of Folland Aircraft and of certain other concerns in order to concentrate his activities on the affairs of the Brush Electrical Engineering Co., of which he is managing director.

* * *

A growing volume of business and the consequent need for bigger premises in the Midlands has resulted in G.W.B. Electric Furnaces, Ltd., moving their Birmingham office and service depot to 21, Steelhouse Lane, Birmingham 4 (Tel. Central 6372).

* * *

A State Aeronautical Reference Library, the first of its kind in the U.S., is being set up at Berry Field, Nashville, Tennessee, and will be free to the public. Volumes of records of Government aviation research from 1916-36 are being loaned from the Cossitt Library in Memphis.

* * *

A Russian cargo-carrying flying boat, with freight for several islands in the Arctic Ocean, recently made a 13-hr nonstop flight under bad weather conditions and with visibility reported as nil. The flight began and ended at Murmansk, and the aircraft dived down to within 150ft of the ground over Novaya Zemlya to drop twenty-seven sacks.

* * *

Mr. W. Thomas, who served as an Air Staff Officer with the rank of Wing Commander and was attached to the Air/Sea Rescue Directorate, has joined the staff of F. Perkins, Ltd., at Peterborough. He obtained his Master's ticket before the war, joined the R.A.F. as a marine craft officer in May, 1939, and was latterly concerned in the development of the airborne lifeboat.

* * *

Howard B. Dean, vice-president of Pan American World Airways, has been appointed administrative vice-president of the company. He succeeds vice-president Harold M. Bixby who will continue as a director and vice-president and will be responsible for Pan American interests in the China National Aviation Corp.

* * *

A lumber company operating among the swamps of lower Louisiana uses a Piper Cub floatplane to supervise the work and to transport sick personnel to hospital. A 40 per cent increase in operating efficiency is claimed as a result, a two-day boat journey being covered in 20 min.

* * *

Electronic flight trainers, which reproduce normal and emergency flying conditions have been ordered by Pan American World Airways. Known as the Dehmel trainer, this device duplicates the flight decks of the Stratocruiser and the Rainbow for pilots and flight engineers, and simulates the flight characteristics of these two new airliner types.

THE de HAVILLAND GHOST (DGT/50)

New Jet Unit Developing 5,000lb Thrust at 10,000 r.p.m.

By F. C. SHEFFIELD

"Flight" photograph.

The Ghost unit terminates in a propulsion nozzle 18½in diameter. A muff around the exhaust cone heats air for cabin warming.

IN 1943 the subject of jet propulsion was still an official secret, but the de Havilland Goblin jet unit, although not in regular production, was progressing satisfactorily under development. The end of the war was not in sight and the authorities, with understandable concern for the future, invited the de Havilland Company to design and build a more powerful unit. The proposal was investigated and a decision taken to build a scaled-up version of the Goblin, which at that time developed a thrust of 3,000lb.

The first drawings were made in April, 1944, for a new unit having an overall diameter of 57in and to develop 4,000lb thrust. Termed the DGT/40, it had fourteen combustion chambers each fed from a single diffuser outlet. Two units were built for experiment and later the output was stepped up to 4,400lb thrust. No suitable aircraft was available at the time but a project for a military machine to utilize the greater thrust of the new unit was undertaken by another aircraft concern. However, the authorities considered an overall diameter of 57in too large and to meet this view a redesign was begun in 1945.

The dimensional problem, the diameter of the compressor diffuser, was solved by the introduction of cascade vanes to turn the air to a substantially axial direction after leaving the diffuser vanes. This feature reduced the diameter to 53in, only 3in more than the Goblin, and, of course, materially affected the weight. Considerations of combustion efficiency made it desirable to use a chamber of greater volume than hitherto and accordingly the number of chambers was reduced to ten. To avoid the use of splitter vanes in the diffuser, separate outlets were taken from each diffuser duct and two of these were arranged to feed each combustion chamber.

The redesigned engine, the DGT/50, was first run in October, 1945 and early in 1946 was developing its rated output of 5,000lb thrust. It will be first flown in a de Havilland Vampire aircraft and it is confidently anticipated that a markedly enhanced performance will result. Further flying experience will be acquired in an Avro Lancastrian in which Ghost units will be fitted in the outboard nacelles whilst Merlin piston engines will be retained inboard. Apart from any military applications, it will be developed for use in high speed transport and civil aircraft.

Design Features

Basically the Ghost follows the proved design of the Goblin unit. To obtain the maximum advantage from ram effect at high speed the air reaches the compressor by way of a duct leading directly to the impeller. The de Havilland company point out that there is no plenum chamber or reversal of direction to slow down the air flow or increase the drag of the aircraft. Hence the designation "high velocity" intake duct.

The radial flow compressor is of the single-sided type. As intake air is not required to pass over the casing, the compressor is of a size closely approaching the prescribed overall installation diameter. For a stipulated air mass flow, this design permits the use of a large diameter impeller running at relatively low speed.

In operation the impeller tends to be drawn forward from its shaft. This effect, however, is substantially balanced by

POWER FOR THE PLANES OF TO-MORROW

ARMSTRONG SIDDELEY

MOTORS LTD

Coventry

In the forefront

of the development of

axial flow compressors

The Mamba Gas Turbine Engine for moderate sized aircraft; for the giants, the Python

BRANCH OF HAWKER SIDDELEY AIRCRAFT COMPANY LIMITED

A10

E

THE de HAVILLAND GHOST (DG/50)

the turbine wheel which exerts a thrust to the rear. It follows that the main shaft connecting the two components is stressed in tension and only a small residual thrust remains to be taken by the locating bearing.

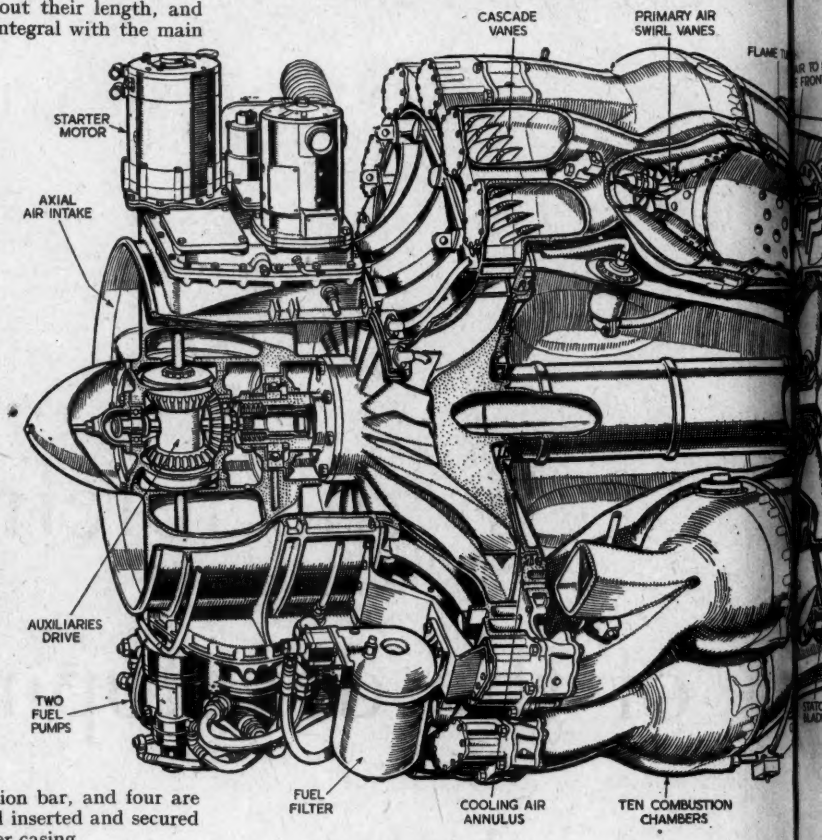
Air Compressor

The impeller is formed from a single forging in a special, low-silicon, high duty alloy. Characteristically, the nineteen vanes are truly radial throughout their length, and the curved entry vanes, which are integral with the main vanes, are not bent to shape but machined from the solid. To the rear face of the hub is bolted the tubular main shaft and to the front face the stub shaft carrying the ball-type front main bearing.

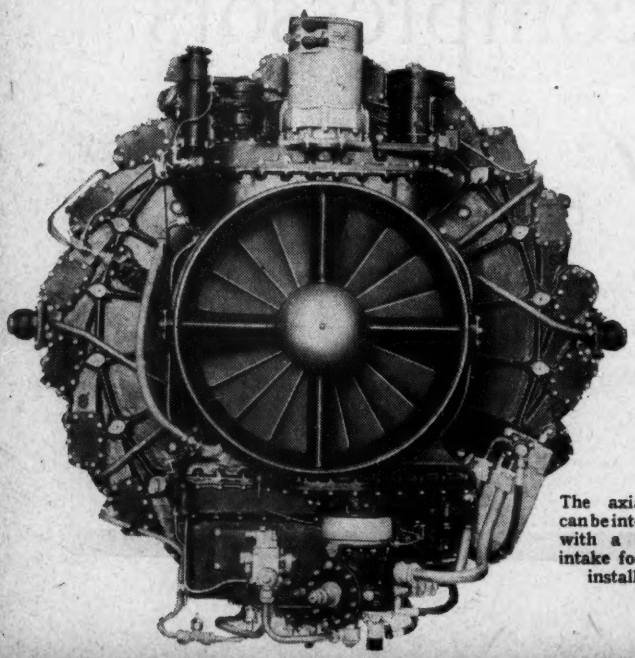
The Goblin had its air intake and upper and lower wheelcases integral with the front casing of the compressor, but on the Ghost all these components are separate castings. This promotes installation adaptability and allows the compressor casing to be truly symmetrical and thus less susceptible to thermal distortion, which might affect clearances. Three interchangeable intakes, one axial and two bifurcated, are at present available.

Integral with the compressor front casing is the diffuser, which has twenty vanes defining tangential divergent ducts. Air delivered from the periphery of the impeller, and flowing through these ducts, undergoes a reduction in velocity and, in accordance with the Bernoulli theorem, a corresponding increase in pressure. After passing through the diffuser it has a pressure of 48lb/sq in gauge—equivalent to a compression ratio of 4.26:1. The air leaves the diffuser tangentially and is turned to a rearward direction by four cascade vanes in each duct outlet. Cascade vanes are cut from an extruded section bar, and four are mounted in a sheet metal shroud and inserted and secured as a unit from the front of the diffuser casing.

The casting which forms the rear wall of the diffuser is channelled at its inner diameter and sealed by a pressed-in ring to furnish an annular manifold. By way of a series of tappings from the diffuser chamber a supply of cooling air is fed under pressure to the manifold. During compression the temperature of the air is raised nearly 200 deg. C and, of course, must be lowered to render the air effective as a coolant. External pipes conduct air from the manifold



to a pair of segmental channels, formed in the front flange of the compressor and closed by the intake casting, where it is cooled by reason of its proximity to the incoming air stream. From each of the channels a pipe delivers air to a filter mounted on the support cone and thence by an internal pipe to the rear bearing. From here it passes between the insulating plate and the front face of the turbine disc and discharges at the blades. Four external pipes from the manifold carry air to the supports of the bullet in the exhaust cone and thence to the rear face of the disc. The compressor is completed by a backplate registered with and bolted to the rear half of the diffuser. Complementary labyrinth grooves are provided in the rear wall of the impeller and in the backplate to avoid air loss, and their diametral position is so chosen that the forward thrust of the impeller substantially balances the rearward thrust of the turbine. In the backplate three inspection plugs interrupting the labyrinth grooves can be withdrawn for checking the clearance. On the front wall twelve lead rubbing plugs, pitched at 90 deg., on three diameters, serve to check the clearance at idling and maximum speeds.

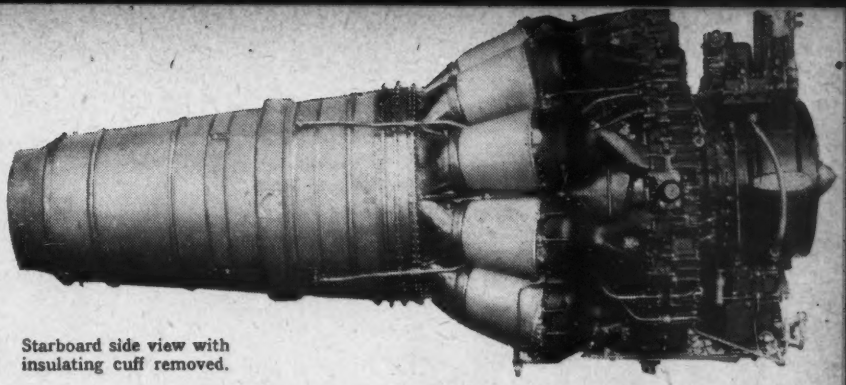


The axial intake can be interchanged with a bifurcated intake for fuselage installation.

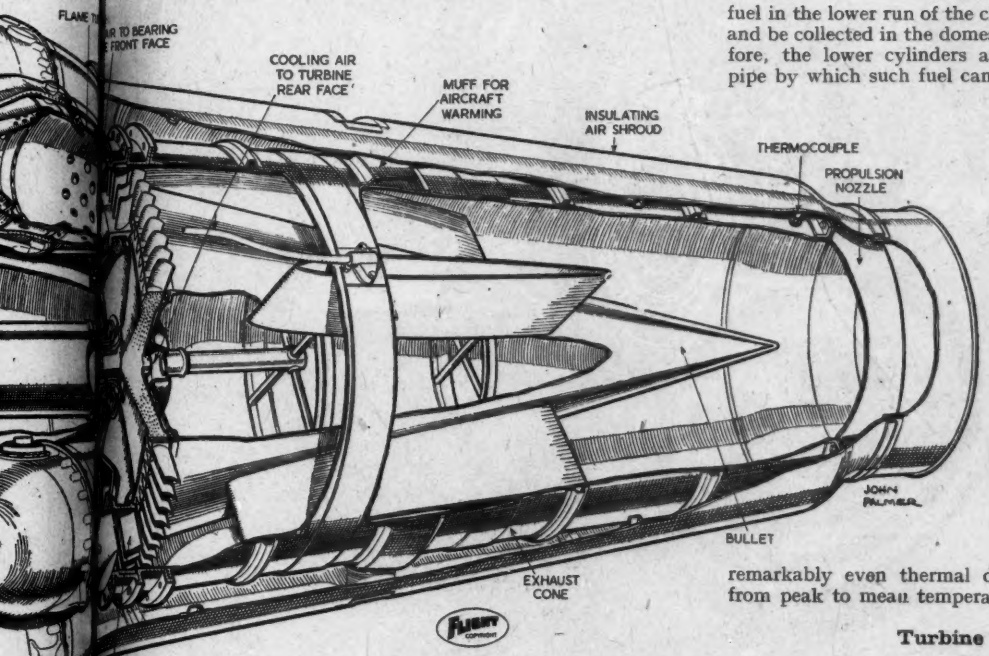
Component items of the fuel and combustion system were developed in collaboration with the research team of Joseph Lucas, Ltd.* Each

* Fuel burning and control equipment and the combustion research facilities of Joseph Lucas were described in detail in *Flight* 3rd and 10th January, 1946.

chamber comprises a branched dome of light alloy, flanged and bolted to a mild-steel outer casing. The dome bolts directly to the rear face of the diffuser, whilst the remote end of the outer casing makes a sliding joint with the turbine nozzle junction ring to permit thermal expansion. Co-axially within the chamber is an assembly consisting of a flame tube capped by a colander. Fabricated from Wiggins Nimonic 75 heat-resistant alloy, the assembly is positioned from the dome by three cast lugs and three inserted



Starboard side view with insulating cuff removed.



Maximum diameter	*53 in.*	*Static thrust*	*5,000 lb.*
Standard length	*122 in.*	*Fuel consumption*	*1.06 lb./lb./hr.*
Dry weight	*2,011 lb.*	*Oil consumption*	*1.5 pt./hr*
Maximum revs.	*10,000 r.p.m.*	*Air mass flow*	*88 lb./sec*

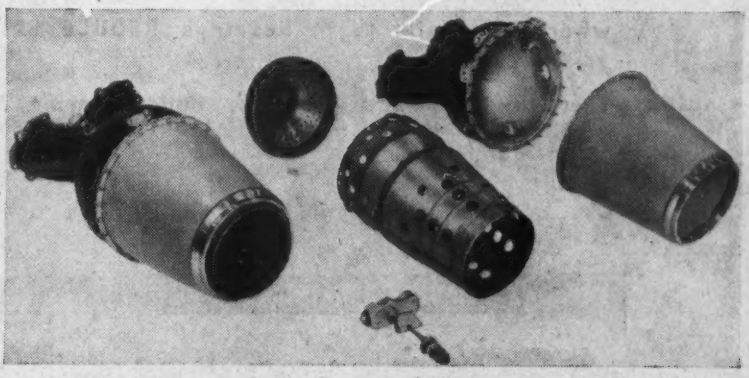
radial supports. One of the latter is constituted by the tubular member by which all chambers are interconnected to effect a pressure balance and permit propagation of the flame from one chamber to another when starting-up.

The burner is entered between the branches of the dome, passes through the metering orifice in the outer cone of the colander and is centred in a ring of swirl vanes in the inner cone of the colander. Of the air entering the dome, approximately 30 per cent passes the metering orifice and swirl vanes for primary combustion of the fuel at a ratio of about 18 : 1. The major portion, however, flows between the flame tube and the outer casing and is fed to the interior of the flame tube by way of a multiple series of holes to dilute the combustion products and lower the heat of the gas to a temperature that can be withstood by the turbine blades. A small portion of this secondary air continues to the end of the flame tube and passes through segmental slots cut in the terminal flange of the outer casing. The overall air to fuel ratio is of the order of 60 : 1 but these figures will vary somewhat in accordance with altitude and operating regime. In the event of a "wet start," when fuel is injected but ignition does not occur, fuel in the lower run of the chambers will tend to flow back and be collected in the domes. As a safety measure, therefore, the lower cylinders are interconnected by a drain pipe by which such fuel can be jettisoned.

It is the aim of the combustion engineer to achieve complete combustion of the fuel without any restriction or impedance of the mass flow. If this were possible the specific pressure at the exit of the combustion chamber would be the same as at the entrance. As some degree of turbulence is essential to consume fuel at a high rate, this ideal is unattainable. Credit attaches to those responsible for the design of the Ghost chamber, however, as the pressure drop from entry to discharge is only 2.8 lb/sq. in. Temperature contour diagrams, taken at the turbine nozzle junction immediately aft of the combustion chamber, show remarkably even thermal distribution and the variation from peak to mean temperature is only 84 deg. C.

Turbine Assembly

The nozzle junction, fabricated from stainless steel, receives the discharge ends of the ten combustion chambers and is supported by a deeply dished diaphragm mounted on the housing of the rear bearing. Flanged to the rear of the nozzle junction is the stator ring having 84 blades which direct the gases to the appropriate angle of attack for the blades on the turbine wheel. Stator blades are stampings of Jessop's G.18 B steel and each is secured by two integral pins riveted through the inner ring and a tongue peened in the shroud ring. After the blades are built in, the shroud ring is divided into ten segments to permit radial expansion without distortion. To the rear of the stator ring is bolted the shroud ring for the turbine wheel and together these three components, nozzle junction, stator ring and turbine shroud, form a drum.



A complete combustion chamber and, alongside, the main components. The burner is secured between the branches of the dome.

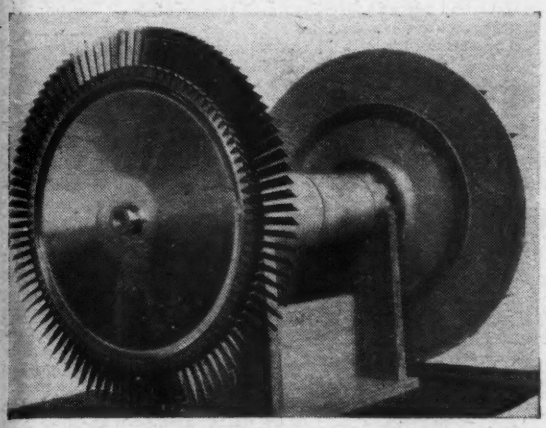
ITS ASSEMBLED MECHANISM REPRESENTS SKILL IN COMPACT FORM
wherever shafts turn, bearings REDUCE FRICTION AND WEAR

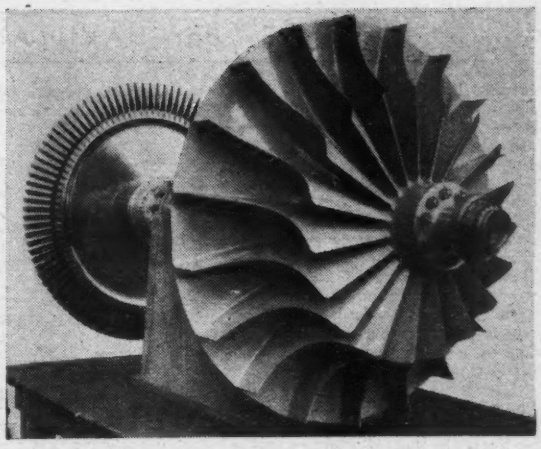
There is an R&M Ball or Roller Bearing for every application

RANSOME & MARLES BEARING Co. Ltd. NEWARK-ON-TRENT

BALL & ROLLER R&M BEARINGS

THE de HAVILLAND GHOST (DGT/50)



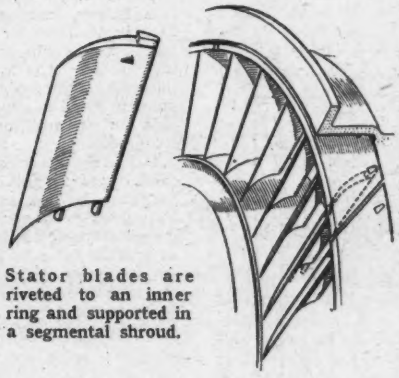


The rotating assembly viewed from turbine wheel and compressor impeller ends. Note the labyrinth grooves on the back of the impeller.

Following de Havilland practice a ferritic steel is chosen for the turbine disc instead of the more usual austenitic steel. It possesses adequate mechanical strength, relatively good creep characteristics and is easier to forge. This last feature is of some importance in the Ghost as the disc is formed with an integral stub shaft instead of being bolted up to a support shaft as in the Goblin.

Turbine Blades

Around the periphery of the disc 97 slots are broached to receive the fir tree roots of the turbine blades. These are individual forgings in the now famous Wiggins Nimonic 80 alloy, precision machined all over to fine limits of dimension and profile. Each blade is given what is virtually a laboratory inspection, and on it is recorded the particular melt of alloy from which it was forged, its weight and moment. Blades are matched for weight and moment, and a set for a turbine wheel is built up by selective assembly. After insertion in the disc the blades are secured by peening over the fir-tree roots on both sides.



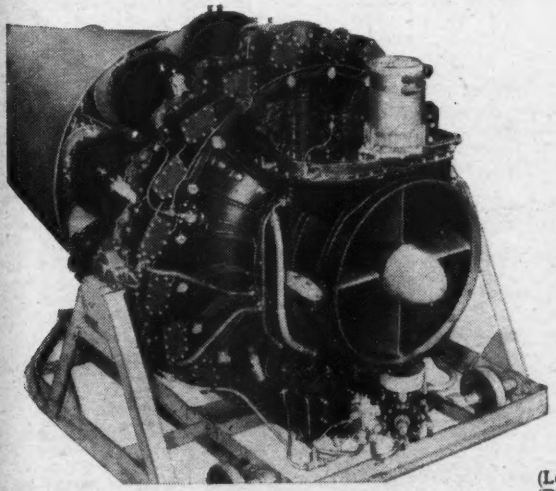
Stator blades are riveted to an inner ring and supported in a segmental shroud.

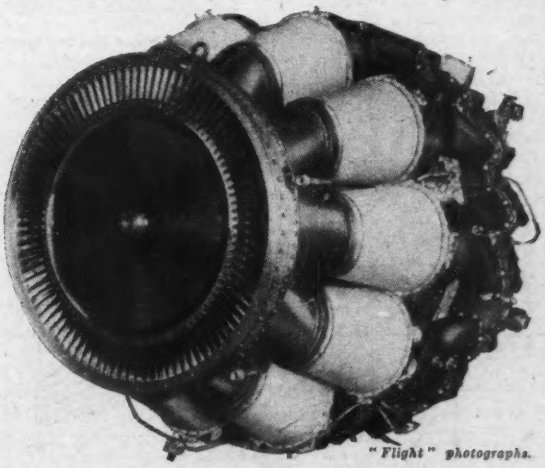
The compressor impeller, main shaft and turbine wheel, together form the complete rotating assembly. The large-diameter tubular shaft is machined all over and has three circumferential ribs for adjustment of balance without mutilation of the designed section. At its forward end, the shaft is bolted directly to the compressor impeller, while to the rear end is secured a tubular extension on which is mounted the rear bearing. The stub shaft of the turbine wheel enters splines in the extension and is drawn up against a large resilient washer which clamps the inner race of the roller bearing by means of a sleeve nut located inside the main shaft.

To manipulate the nut, a long tool bar with a splined end to engage internal splines in the sleeve nut, is centred in a guide fitted in the compressor shaft. It is necessary for such an important nut to be securely locked, and this is effected by a dog clutch device. One clutch element is riveted to the inner face of the head of the nut and the complementary member is non-rotatable but can slide in its mounting in the end of the turbine stub shaft and is held into engagement by a helical spring. On the end of the tool is a pilot stem which disengages the wheel clutch member by depressing it against the spring before the tool splines are entered into the nut. When making an assembly, contact of the pilot stem with the wheel clutch member gives a sensory and also a visual indication that the locking clutch is properly engaged.

As the rotor assembly has to operate at speeds up to 10,000 r.p.m. it is meticulously balanced. Each of the three main components is balanced individually and then the complete assembly is dynamically balanced.

The compressor casing and the turbine assembly drum are





"Flight" photographs.

(Left) For transport the unit is mounted on a wheeled cradle and crated. (Right) Removal of the exhaust cone exposes the turbine wheel.

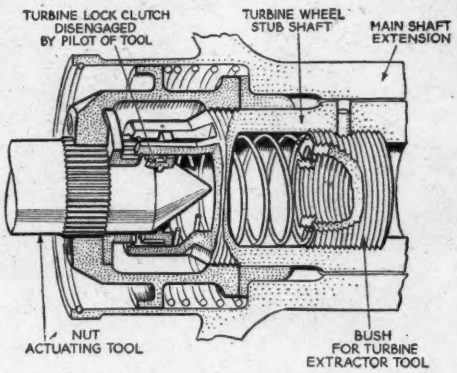
THE de HAVILLAND GHOST (DGT/50)

bridged by a stiff steel shell of truncated conical shape. On its outer surface this support cone is highly polished and serves as a reflector to prevent the transmission of heat radiated by the combustion chambers from reaching the internal assembly. The cone is divided and the larger diameter forward part, which is flanged to the rear diffuser casing, is dimpled to clear the combustion chambers. Flanged to the end of this member is the smaller rear part which, at its extremity, is bolted up with the turbine diaphragm at the rear bearing housing. From the junction of the diaphragm with the stator blade ring, a cylindrical steel member extends forward to meet the junction of the two parts of the cone. Ten tubular stays, passing between the nozzle junction pipes, brace the outer flange of the stator ring to the support cone.

Bolted up to the turbine shroud is the stainless steel exhaust cone consisting of an outer member from which the inner cone or bullet is supported by tubular stays enclosed in four streamlined fairings. The insulating plate closing the forward end of the inner cone is spaced from the turbine disc and serves to define the path of cooling air which, as mentioned earlier, is introduced by way of four of the tubular supports and an axial tube. To the extremity of the outer cone is attached the propulsion nozzle which has an effective diameter of 18.5in. Adjacent to the nozzle a thermocouple is inserted in the cone to furnish an indication of the operating temperature to the pilot.

A muff encircling the outer cone receives, from an external source, air which absorbs heat in passing round the cone and is used for warming the cabin and, on military machines, the armament enclosure. As a safety measure the exhaust cone is enclosed by a spaced conical shroud. The jet flow at the nozzle exercises an ejector action thus inducing a flow of air, approximately 120 cu ft/min, between the shroud and the exhaust cone and also serving to ventilate the engine enclosure or nacelle.

The standard length of the exhaust cone is 51in but to suit particular installations an extension tube can be fitted between the cone and the propulsion nozzle. The use of an extension, however, will have a somewhat adverse effect on performance; slightly reducing the thrust and increasing specific fuel consumption.


TURBINE LOCK CLUTCH DISENGAGED BY PILOT OF TOOL
TURBINE WHEEL STUB SHAFT
MAIN SHAFT EXTENSION
NUT ACTUATING TOOL
BUSH FOR TURBINE EXTRACTOR TOOL

The turbine wheel nut is locked by a spring-loaded dog clutch device.

Auxiliary Equipment

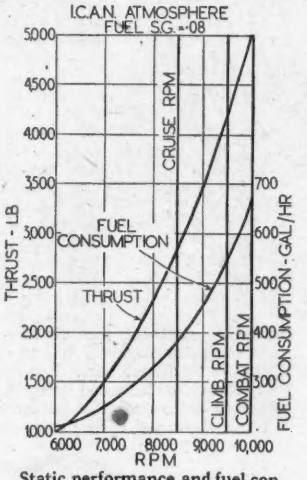
Auxiliaries are mounted on upper and lower wheelcases attached to the air intake casting on the front of the compressor. The drive shaft assembly in the hub of the intake comprises a short shaft with an integral bevel wheel, mounted on two ball bearings and driven from the end of the impeller stub shaft. The bevel wheel meshes with a pair of pinions from which the drive is taken to upper and lower wheelcases by vertical quill shafts. In the wheelcases, distribution is by means of spur gears.

On the upper case is the starter motor, Marshall pressurization blower, compressor for the aircraft brakes, 1,500 watt 24 volt generator for aircraft services, vacuum pump for instruments and cabin sealing, and the generator for an electric tachometer. The lower case carries the two Lucas-Ifield fuel pumps and the hydraulic pump. The total weight of the components listed is approximately 145 lb. A spare drive is available for an additional generator on the upper wheelcase if required.

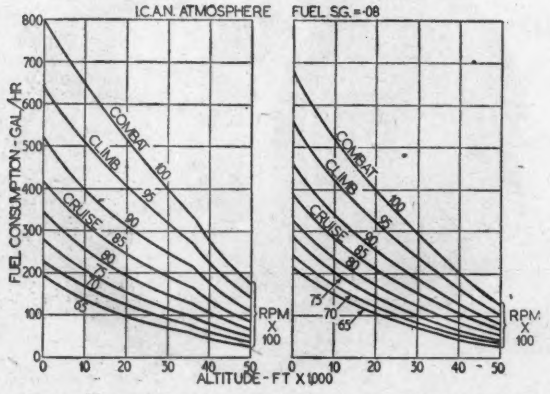
Below the lower case is the oil sump which has a consumable capacity of 2¼ gallons and is cooled by air induced into the enclosure by the exhaust cone shroud, as described earlier. No separate oil cooler is needed. A gear type pump raises the pressure of oil drawn from the sump, and supplies are fed at specific rates of flow to the front and rear main bearings by Tecalemit micro metering pumps. From the front bearing the supply drains to the sump, but from the rear the surplus is conducted to the fuel drain and jettisoned. Maximum consumption for all purposes is 1.5 pt/hr.

Fuel System

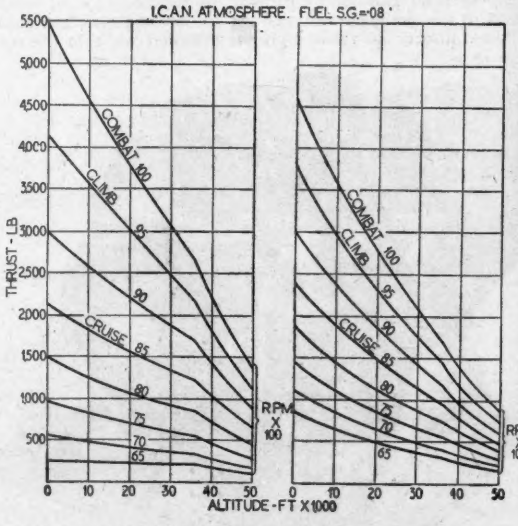
As is usual for aircraft turbine units, the fuel is aviation kerosene with an added 1.0 per cent of lubricating oil. The calorific value is 10,310 C.H.U./lb (18,558 B.Th.U./lb) and



Static performance and fuel consumption at sea level.



Fuel consumption rate at various r.p.m. (Right) Aircraft speed 300 m.p.h. (Left) Aircraft speed 600 m.p.h.



Variation of thrust with r.p.m. (Right) Aircraft speed 300 m.p.h. (Left) Aircraft speed 600 m.p.h.

the specific gravity of the fuel is 0.8.

From the aircraft tank the fuel is delivered by a Self-Priming pump through a Vokes low-pressure filter to the two Lucas-Ifield variable-stroke pumps. Only one pump is fitted with the overspeed device but the servo system actuates both pump controls. These are interconnected with a single barometric pressure control unit, and deliver the fuel past the pilot's throttle valve and the shut-off cock to a ring manifold. The pump circuits are linked together under the control of a solenoid-actuated valve. In the event of the failure of either pump or the stoppage or fracture of their pipe lines (as, for example, by enemy action) the pilot will be warned by a sharp drop in r.p.m. Operation of the solenoid valve from the cockpit will automatically shut off the faulty unit and the remaining pump takes on the entire duty, which is well within its individual capacity.

From the ring manifold the fuel is delivered by individual pipes to the Simplex type burner in each combustion chamber. Closure of the shut-off cock automatically opens the dump valve and drains the fuel manifold. Torch igniters are fitted to two of the combustion chambers.

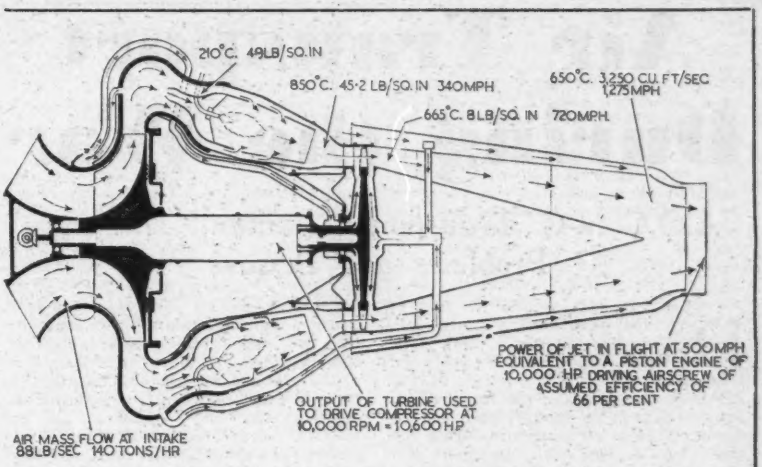

210°C. 49LB/SQ.IN
850°C. 45·2 LB/SQ.IN 340MPH
650°C. 3250 CU.FT/SEC 1,275MPH
665°C. 8LB/SQ.IN 720MPH
POWER OF JET IN FLIGHT AT 500MPH EQUIVALENT TO A PISTON ENGINE OF 10,000 HP DRIVING AIRSCREW OF ASSUMED EFFICIENCY OF 66 PER CENT
OUTPUT OF TURBINE USED TO DRIVE COMPRESSOR AT 10,000 RPM = 10,600 HP
AIR MASS FLOW AT INTAKE 88LB/SEC 140 TONS/HR

Diagram of gas flow, velocities, temperatures and pressures. Figures relate to sea-level conditions.

Installation

The unit can be slung from three eyebolts; two on the compressor casing and one from the junction flange of stator blade and turbine shroud rings. Around the periphery of the diffuser casing are four facings permitting the unit to be mounted on a pair of diametrically opposite horizontal trunnions and steadied at a third point either at the top or bottom of the casing. Alternatively it may be mounted from four pick-up points, furnished by eyebolts passing through the diffuser, on a braced framing similar to that conventionally employed for radial type piston engines. In cases where additional length is required for the exhaust assembly, an extension pipe, not exceeding 2ft in length, may be built on to the exhaust cone and mounted on the engine without requiring additional support from the airframe. The dry weight of the unit is 2,011 lb and includes all engine auxiliaries but no accessory components for aircraft services. In running order, complete with listed aircraft accessories, the weight is 2,096 lb.

As is generally known, both Goblin jet units and Vampire aircraft have been sold abroad and already foreign countries are exhibiting marked interest in the new Ghost unit.

A.A.F. and R.A.F.V.R. Developments

Details of Recruiting for Non-regular Air Forces

SIGNIFICANT developments designed to strengthen and expand the non-regular Air Forces (Auxiliary Air Force and R.A.F. Volunteer Reserve) were announced by the Rt. Hon. Philip Noel-Baker, Secretary of State for Air, last week.

The first concerns the A.A.F., in which "Air-Defence" units, for the raid-reporting and fighter-control systems of the U.K., will be formed. These will play an important part in the manning of Fighter Command and Fighter Group operations rooms, sector operations centres and rooms, radar reporting stations and associated units. Full notification will be given in the immediate future as the units become ready to receive recruits from among wartime officers, airmen and W.A.A.F.s., particularly those experienced in the type of work offered. Some Territorial and Auxiliary Forces Associations have already been approached concerning the raising of units within their areas, and in due course Town Headquarters, with training and recreational facilities will be provided at a number of centres. As with other A.A.F. branches, training will be undertaken during the evenings, at week-ends and for an annual period of fifteen days' camp or exercises.

For the close-defence of R.A.F. airfields some squadrons of the A.A.F. Regiment are also to be formed, but no date has been fixed for the commencement of recruiting.

A further development is the institution of Supplementary Lists for officers, one for men and one for women. They are open to ex-officers who wish to maintain their connection with the R.A.F. and are prepared to volunteer immediately for service if this should be required in an emergency. Enrolment is open to any officer no longer serving who has held a wartime commission in the R.A.F., in any of its Reserves or Auxiliaries or in the W.A.A.F. since September 2, 1939. These officers will not be required to undertake peacetime training unless they choose to join units of the non-regular Air Forces.

Applications for enrolment on the Supplementary Lists should be addressed to the Permanent Under-Secretary of State, Air Ministry, Adastral House, London, W.C.2, those from Air Force officers being marked on the outside "For the attention of A.R.2," and those from W.A.A.F. officers "For the attention of S.11."

A new R.A.F.V.R. departure will be the formation of ancillary units, e.g., M.T. companies, air stores parks, ammunition parks and embarkation units, which will not be required to operate until an emergency arises. These units, therefore, can be raised with comparatively small training obligations.

Another V.R. development is the imminent recruiting of ex-pilots and later of navigators. Flying training will be given at a number of civil schools and notification will be made in the Press when recruits can be accepted. The target date for the opening of the first schools is April 1st; others will follow throughout 1947 and 1948 until all the major centres of population in Great Britain and Northern Ireland are covered.

Questions to Mr. Noel-Baker and to Air Chief Marshal Sir John Slessor, Air Member for Personnel, elicited the information that the civil flying schools to be opened on April 1st will be Perth, Brough, Derby and Woodley. Eleven schools should be established during 1947 and twenty-five by 1948.

Concerning University Air Squadrons it was announced that these have been formed at eleven Universities in Great Britain and Northern Ireland as units of the R.A.F.V.R. The majority of the squadrons are for flying personnel, but those at Birmingham, Nottingham and Southampton, while having a flying programme, emphasize technical experience to assist the recruitment of the newly constituted Technical Branch of the R.A.F.

FORTHCOMING EVENTS

Feb. 11th.—R.Ae.S. Belfast: "Electrics in Aircraft," Mr. Woodford.
Feb. 15th.—Pathfinder Association: Grand Ball, Dorchester Hotel, Park Lane, London, W.1. 8 p.m.
Feb. 15th.—Soc. of Licensed Aircraft Engineers: "Aviation Fuel—A Review," Air Cdr. F. Banks.
Feb. 18th.—R.Ae.S. Bristol: "Radar—Its Uses and Possibilities in Civil Aviation," F. R. Wills (B.O.A.C.).
Feb. 19th.—R.Ae.S. Birmingham: Debate with Coventry branch. 7 p.m.
Feb. 19th.—R.Ae.S. Southampton: "Problems in Fighter Design," R. L. Lickley.

Air Transport During the War

A.O.C.-in-C. Transport Command Discusses Problems and Lessons

TRANSPORT Command, says Air Marshal Cochrane, has now shrunk to a shadow of its former self. This has the compensation that more time can be devoted to a study of the problems he outlined in his recent lecture which is summarized herewith.

Sir Ralph Cochrane.

DEALING particularly with the twenty-one months ending September, 1946, Air Marshal the Hon. Sir Ralph Cochrane, K.B.E., C.B., A.F.C., lectured before the Royal Aeronautical Society on January 30th, on the development of air transport during the war. In this period the transport services of the R.A.F. completed more passenger miles than had British civil aviation in the preceding twenty-one years; rapid development gave rise to many problems and afforded unique opportunities for testing new ideas and equipment.

The Air Marshal illustrated graphically the growth of services and mentioned that some half million troops and 200,000 tons of equipment were carried. Crews responsible were awarded more than a hundred decorations, including one V.C. Mention was made of such men as A. Cdre. Fletcher, A. Cdre. Brackley and A. Cdre. Whitney-Straight, who gave valuable opinions, to the close contact with B.O.A.C. and to the sound foundations laid by Sir Frederick Bowhill.

Discussing safety Air Marshal Cochrane referred to the regular training, especially in emergency situations (e.g., engine-cut on take-off), and outlined the categorization test to which all aircrew members were subjected with the object

Some half a million troops and 200,000 tons of equipment were carried.

of ensuring that they were employed within the limitations of their skill, knowledge and experience. Only those who achieve the higher categories are now allowed to carry passengers, and until they have reached the necessary standard are limited to freight services.

During 1945, no fewer than 3,000 pilots —or three times the total of pre-war "B" licences—were absorbed into the transport organization. While some were transferred from other Commands, the majority came direct from the training organization with a total flying experience—dual plus solo—in the region of only 300 hours. Any attempt to increase the time spent in basic training would have been at the expense of the transport "job," on which depended, among other things, the safety of the 14th Army in Burma. In the circumstances, Air Marshal Cochrane considered that a fair balance was struck, but the results achieved were only possible through a scientific study of the problem.

That the method of presenting information to the pilot could be simplified was obvious, but the tendency was to ask for more information, so that the tide was still running towards further complication. A more important side to the problem was the simplification of the whole art of flying and navigation, especially in bad weather. Of all weather hazards that of flying into ground was probably the most serious.

By 1945 GEE chains had been installed to cover Western Europe, including France and the Western Mediterranean. They have proved invaluable and a very real contribution to safety. There were, however, many parts of the world where navigation aids had not reached

During 1945, no fewer than 3,000 pilots were absorbed into the transport organization.

the same high standard. To meet the needs of these areas a radar warning device had been developed and was now ready for trial. With this, and the other aids available, the risk of accidents caused by faulty navigation should be much reduced.

Concerning take-off and landing hazards, the Air Marshal said that although the main R.A.F. airfields were equipped with radar beacons giving direct distance measurement as well as bearing, this in itself was not enough and the crew needed a map which would show unmistakably the minimum height to which it was safe to come down during the last few miles of the approach. For this purpose special maps had been designed by the Navigation Staff of Transport Command, tinted in bands representing 500 feet clearances above the airfield level so that safety heights could be seen at a glance.

Regarding the risk of collision with other aircraft it was pointed out that on many occasions during the war traffic densities were a hundred or more times the maximum allowed by civil regulations, but that collisions were rare. Nevertheless there was a risk, and trials were now under way with a radar detecting device. For some time to come,

On many occasions traffic densities were a hundred or more times the maximum allowed by civil regulations but collisions were rare.

however, aircraft must rely mainly upon routeing instructions and good traffic control.

Greater than the risk of collision with other aircraft was the danger of becoming involved in a dangerously turbulent cumulo-nimbus cloud. During the period under review six aircraft were lost in this way though none were lost due to collision. Transport Command aircraft were now timed to pass by day through areas where really bad conditions were likely to be found. These areas were fairly well defined, e.g., India and Burma during the monsoon. During the 1946 monsoon the Telecommunications Research Establishment tried out in South-East Asia a warning device on which dangerous clouds were clearly represented on a cathode-ray tube in a form which would enable the pilot to avoid flying into them. Reference was made to a "rather nasty looking cumulus" which gave no response and which, on being flown through, was found innocuous.

The equipment was now undergoing further tests at the Transport Command development unit, to ascertain whether it could help in the negotiation of an active cold front and whether bad icing conditions could be detected. Representatives of the Ministry of Civil Aviation and the Airways Corporations had been invited to attend the trials which, like so much else of value to aviation, derived from the scientific resources and magnificent team work of T.R.E.

Few accidents were directly ascribed to fatigue, yet its effects were probably

Six aircraft were lost by flying into cumulo-nimbus cloud though none was lost due to collision!

present in many accidents labelled "error of judgment." The Air Marshal referred to the work of Professor Bartlett and to a Transport Command medical officer who was a qualified pilot and who, by flying various routes himself, and living with squadrons and at staging posts, concluded that on long-distance flights the chief causes of fatigue were to be found on the ground and not in the air.

A final point concerning safety was that unless close watch was kept on every aspect of flying and administration, practices would creep in which would carry with them potential causes of future accidents.

Concerning regularity, the first essential for which was a system of communications, the Air Marshal said that at the peak of Transport Command acti-

AIR TRANSPORT DURING THE WAR

vities, communication services absorbed no fewer than 21,000 men, running a world-wide network of W/T and R/T communications, navigation beacons and D/F stations. Much could be done to economise, but if regularity was to be achieved a first-rate communications system was essential, and this would cost money. The history of No. 147 Squadron was quoted as an example of what could be achieved in the way of regularity.

An even better indication of what could be done when full aids were available was afforded by the results of the experimental "all-weather" service started on September 15th, 1945, between Blackbushe and Prestwick. It ran for one year. The route of 400 miles was chosen because it passed through areas notorious for bad weather and poor visibility. The total number of flights planned was 668 and of these 666 were completed and, of equal importance, the start of a flight was never delayed on account of weather either at the point of departure or forecast for the destination.

The total number of flights planned was 668 and of these 666 were completed

The "Fido" at Blackbushe was used on five occasions.

Concerning landing rate, the lecturer said that a great deal had been learnt from trials with four Dakotas, a Halifax and a Mosquito, utilizing equipment designed by the T.R.E. Trials would shortly retart with improved equipment, but a landing rate of one a minute was still some distance off.

The Air Marshal went on to refer to the possibilities of dropping loads by parachute and by dropping newspapers in mail bags from about 500 feet, the dropping points having been found with the assistance of Eureka radar beacons. Of one series of 176 free drops 160 were made on instruments and averaged 308 yards from the beacon. The remaining 16 were visual drops and averaged 250 yards.

Contrary to general opinion, economy was as vital in the Service as in civil air transport. In the Service the currency was man-power and the problem was to get the maximum output of useful transport work from the resources allocated. In the last war the demands on transport were never satisfied, so that every unnecessary inspection, or every delay caused by replacement of a part, was at the expense of load waiting to be carried.

Having had to use, of necessity, what was available, it was at any rate possible to have views on the old argument of reliability versus weight. Was it better to make components robust for reliability, or must payload be the first consideration? The Air Marshal's own view was that reliability must come first, and that payload would then look after itself, for not only would the total ton/mileage be higher because the aircraft would do more flying, but it would be found that reliability could be achieved without increase of weight.

As a first stage towards economical transport flying, an engine which would run without trouble for at least 1,000 hours was desirable; but if that could not yet be achieved, it was essential that within that figure the engine should be free of defects. This was at least as important as length of life, because nothing was more wasteful than the need to replace engines or major components at some point along the route. At one stage of the trooping programme with 130 aircraft in daily flight along the India route there were 20 aircraft held up for engine changes. Later this number was reduced to seven, but even seven aircraft static on the route was far too high a price to pay.

Apart from the failure of major components necessitating an engine change, much work was entailed in maintaining the great number of engine-driven components. The ideal was that the power plant should consist only of the engine and the associated equipment necessary to its functioning, all items being capable of running 1,000 hours without attention. Examination of the maintenance costs for 1½ millions of power plant running hours showed that for every running hour approximately one man-hour was required for maintenance in the field.

Airframes, in general, did not give over-much trouble, but there were a number of minor defects which could probably be cured. As an example, rivets failed, with consequential skin panting, on mainplanes and control surfaces. This led to minor structural failures. The difficulty of making joints, especially cabin canopies, watertight, brings endless trouble. It caused electrical shorts and instrument failures which, apart from the inconvenience to crews, might endanger the aircraft's safety through failure at a critical time of the radio and radar services. There was also the fire risk. Corrosion was another problem, particularly operating in extremes of climate, a secondary effect being, of course, rivet failure. Materials which were proof against corrosion were urgently required.

Tyres were another prolific source of trouble. In spite of improved methods of tyre inspection which have raised the average landings per tyre for the York and Halifax from 20 to 70, the aim of 200 landings per tyre was still far in the distance. Cuts, beyond unit capacity to repair, accounted for 70 per cent of all the tyres discarded.

The root cause of troubles with electrics and instruments was the lowering of standards occasioned by the war.

So long as failure of components has to be accepted an adequate and properly distributed supply of spares was essential, yet in spite of all the thought given to this problem, we did not seem to have achieved a satisfactory and economical solution.

Turning to the value of long range and high speed Air Marshal Cochrane said that we were fortunate in being able to make a direct comparison between the capacity of the Dakota and the York, since both were used on the trooping route to India. Any complete costing would have to include capital expenditure and a host of other items which are not available. Therefore he restricted the comparison to the number of pilots required, and the man-power employed along the route, the latter depending primarily on the number of refuelling stops required.

The shorter range and slower speed of the Dakota necessitated nine refuelling and rest points on the round trip as against five for the York. At each station, in addition to the men required for servicing, others were required to man signals communications and airfield services, to attend to the needs of the personnel in transit, to run motor transport, and to perform other duties. The numbers employed at each refuelling base varied between 600 and 1,000 and the cost was high, especially in such places as Bahrein and Sharjah in the Persian Gulf. The longest stage on the Dakota route was 880 nautical miles in a scheduled flying time of seven hours. For the York it was 1,300 nautical miles in a flying time of seven and a half hours, an increase of almost 50 per cent for only an extra half-hour's flying.

Discounting the York's greater carrying capacity, 35 per cent more troops were moved for each crew employed because of its increased speed and 65 per cent more troops were moved per person manning the route because of the greater range. Considering the cost of training aircrew to the transport standard, an increase of 35 per cent in the numbers carried per crew was an important contribution to economy, while the saving in man-power along the route was even greater—all this for an increase in speed and range by no means unspectacular.

As a first stage towards economical transport flying an engine is needed which will run without trouble for at least 1,000 hours.

CYRIL UWINS ASST. M.D.

HIS many friends in the aircraft industry and R.A.F. will be gratified to learn that, on his retirement from the post of chief test pilot at Bristols, Capt. C. F. Uwins has been appointed assistant managing director of the company's aircraft division.

Capt. C. F. Uwins O.B.E., A.F.C., F.R.Ae.S.

Capt. Uwins has had a long innings as test pilot, having been with the firm since 1918, when he was seconded from the R.A.F. to the Bristol company. On demobilization in 1919 he joined the firm, and ever since he has made the first flights on all the Bristol types produced, as well as doing a great deal of other flying, including the setting-up of a world's altitude record of 43,976ft in a Vickers Vespa powered by a Bristol Pegasus engine. His flying career was described at length in our *Britain's Test Pilots* series in our issue of March 21st, 1946.

In his new post of assistant managing director of the aircraft division, Capt. Uwins will be in a position to bring all his vast experiences to bear upon future designs, and the actual testing responsibility will be literally in the good hands of Mr. A. J. Pegg, whose career is outlined in our test pilots series in this issue.

CIVIL AVIATION NEWS

First Meeting of N.C.A.C.C. : Thames Flying-boat Base : Bristol Tour

AIR JUNCTION : *Star Dale*, one of British South American Airways' Yorks, being refuelled at Lisbon before taking off on the nine-hour flight to Dakar.

JET TRANSPORTS

ADMIRERS of the American Republic Rainbow transport which, with four Pratt and Whitney Wasp Major piston engines is to cruise at 400-440 m.p.h., according to range required, have been dreaming of a version with four Rolls-Royce Nenes. Well-matched and desirable as this combination might appear—for the Rainbow and Nene are probably the most advanced aircraft and power plant in their own classes—it has been declared impracticable by Mr. C. R. Smith, chairman of the board of American Air Lines. This company, having ordered Rainbows, has investigated the possibility of "installing jet power," as Mr. Smith put it, but has encountered aerodynamic problems necessitating "new wing conformation and structures."

This, of course, must not be taken to imply that the installation of jet units is a physical impossibility but more probably is meant to suggest that in order to obtain worthwhile benefits basic alterations are imperative. Although these modifications will not be undertaken, Mr. Smith indicates that new aircraft, presumably designed from the outset for jet propulsion, are the subject of development in which A.A.L. are participating.

Interesting as this news may be in itself, of greater immediate significance is another statement by Mr. Smith that the importation of British jet propulsion units "for the first experimental installation and comparison with American power plants of this type" is planned by American Air Lines. This announcement is quite independent of that in *Flight* of December 12th last year to the effect that the Taylor Turbine Corporation has acquired the licence to manufacture and distribute Rolls-Royce jets and turbines in the U.S.A.

It is known that in addition to the Rainbows, A.A.L. have ordered Convair 240s and Douglas D.C.6s, neither of which types appears more suitable for adaptation to jets than the Rainbow. Like the big Republic, these would be more amenable to the use of airscrew turbines. It has already been announced that the Martin 303, a machine of the same general character as the Convair 240, is to be fitted with "prop-jets" though it is to be expected that this form of power plant, like the pure jet, will be proved initially in freight-carrying aircraft.

All available evidence indicates that an entirely new breed of pure-jet transports will appear in the U.S.A. within a few years, and that adaptation of existing airframes for jet propulsion will be a small-scale expedient rather than a long-term policy. This parallels development in Great Britain where, following the successful trial installation of two Nenes in a Lancastrian, six Tudor IIs are to be flown with four Nenes, and where Vickers-Armstrongs have made a Viking design study for two of these 5,000-lb Rolls-Royce's.

Mr. C. R. Smith having stated an operator's views on the application of turbine power to commercial aircraft, it is interesting to consider some remarks by Mr. L. S. Hobbs, Vice-President of Engineering to the United Aircraft Corporation which makes Pratt and Whitney engines. Mr. Hobbs maintains that there will be a lapse of at least five years before turbine power plants "come into commercial airline use" and that a second five-year period will probably pass before piston engines begin to move out of the picture. His company is spending ten times as much on engine research as at any time before the war, much of it on turbines, but enough on reciprocating engines that the air lines can expect still further refinement in the piston engine before it becomes obsolete. He mentions the "compounding of exhaust power" as the principal development yet to come in reciprocating engines.

Mr. Hobbs' remarks are of particular interest in view of the fact that Rolls-Royce and Bristol are developing civil power plant installations of their largest military units, and that the compounded engine is known to be the subject of intensive development in this country.

On the subject of aircraft Mr. Hobbs takes the view that it will be at least four years before a passenger aircraft is available to make efficient use of turbine power, and that this would hold good even if suitable jet or airscrew turbines were now available. Moreover, much remains to be learned of the effects of 500-m.p.h. cruising on passengers and equipment and much flying must be done in the 400-m.p.h. range, where piston engines are perhaps more efficient than jets, before higher operating speeds are feasible. Jet fighters and even modern high-speed transports must reduce speed in turbulent air to well below their normal cruising speed.

The application of multiple jets to current airframes and to newly projected transports (other than extremely large machines and flying wings, which may have "buried" units) will result in some interesting wing and inboard mountings, the most promising of which seems to be that adopted by Consolidated-Vultee for their new bomber illustrated on page 154 of this issue. This entails the grouping of units in pairs, in two nacelles, thus reducing drag and permitting retraction of the undercarriage wheels between the jet pipes. Wing nacelles seem equally promising on twin-jet transports though Fokker, in the F.26 (see *Flight* of November 21, 1946), has considered it advantageous to mount the units side by side in the bottom of the fuselage.

LORD NATHAN'S COUNCIL

AT the first meeting of the National Civil Aviation Consultative Council on January 27th, Lord Nathan, in an introductory speech, presented some of the wider problems of policy which will have to be faced. He stressed that the responsibility of the Ministry covered the whole field of civil aviation in the United Kingdom, and he was conscious, he said, of the importance of private and club flying. He hoped the Council would be able to advise him on all of the many aspects.

Lord Nathan suggested that we rarely stopped to analyse just what civil aviation meant in the world to-day, and he felt that until we were able to see clearly its real functions we could not guide it straight towards its full development. As the air services provide increasing safety, regularity, and more speed at a decreasing cost, so more and more trade will go by air. Trade through air transport will, he considered, turn out to

CIVIL AVIATION NEWS

be the prime function of civil aviation. He urged also more air travel for the man-in-the-street. This would be possible only when air travel ceased to be an adventure and became a routine, and when the cost came within the reach of all. For both of these functions the Minister stressed the need for safety. We shall find it simpler, he said, to arrive at correct solutions if we bear in mind how aviation will fit in with the general economy and social welfare of the community. We must approach the problems with the idea of finding a solution which will best enable us to develop it not only as an economically but as a socially valuable means of transport. A good slogan, he thought, would be: "Your air services are as good as your airports and your air traffic control."

Safety Factor

Referring again to safety, Lord Nathan said that at present we were flying ten million passenger miles per fatal accident. It was his aim not merely to double that but to reach infinity. If we were to achieve the greatest possible measure of safety, there were problems other than the more obvious ones connected with bad weather. He referred especially to the tendency towards steadily increasing take-off and landing speeds. This, he said, could not continue indefinitely, and designers and research engineers would have to find a method of calling a halt to it. It may be that to achieve this it would be necessary to accept some slowing down in the progress towards higher cruising speeds, but we must not make mere speed into a fetish. During the subsequent short discussion Sir Frederick Handley Page drew attention to the position of the designers, who were merely fulfilling the requirements of the operators for fast-flying aircraft. It was, he considered, necessary for the operators to change their policy. It is interesting here, perhaps, to record the words of Mr. A. Plesman, President of Royal Dutch Airlines, made in a recent speech, that "supersonic speeds offered no great prospects for civil aviation." Lord Nathan rightly said that too much of our land and too much of our money was already swallowed up in concrete runways, and we cannot give designers much more latitude in the way of runway dimensions.

To enable the lessons of day-to-day operation to be applied to new equipment and to new methods of operation, operational research is obviously of vital importance. Lord Nathan is setting up in the Ministry an operational research organization to work in close co-operation with the Corporations and other operators. The committee has already been set up with a very distinguished membership.

The future training of aircrew presents a particular problem. At the present moment, as Lord Nathan said, there is no lack of recruits from the R.A.F., but this source can be relied upon for only a little longer. And yet there is no other way at the moment by which a young man without considerable private means can obtain the basic training he needs. This is a serious problem for consideration by the Council. Undoubtedly the members of the Council, qualified as they are in their own particular spheres, are in a position to give the Minister great assistance. All problems will be considered frankly and fully, and each member will be able to give an opinion whether or not the problem concerns his own special branch.

Sir Henry Self gave members of the Council some idea of the workings of the Ministry, which has expanded fourfold since its inception in 1946. Mr. Lindgren, the deputy chairman of the Council, drew comparisons and parallels between the operations of railways and airlines.

The next meeting of the Council has been fixed for March 31st, which is a long time to wait in view of the urgent problems which must be confronting the Ministry at the present time. At this first meeting, which was purely introductory, scarcely any business was discussed, and it would seem a pity that two months are to pass before any effective consultation can take place.

FLYING-BOAT BASE

MR. LINDGREN has disclosed that the Government have examined the recommendations made by the Pakenham Committee for a marine base. The Committee recommended Langstone Harbour and Cliffe as possible sites for a major flying-boat base, their first preference being for the former. Langstone Harbour is, of course, the stretch of water to the east of Portsmouth, having adjacent waste land which could be developed for a landplane terminal. Cliffe is situated on the south bank of the Thames Estuary, east of Gravesend and north of Chatham.

The Government have now considered all the relevant circumstances and have come to the conclusion that the balance of national advantage lies against any further consideration being given to the Langstone Harbour scheme. It is understood that the Government have taken into consideration not only the point of view of civil aviation but also that of local interests. Mention is made, however, of overriding difficulties that would arise from the proximity of Langstone Harbour to Portsmouth as a main naval base. In view of this, the Minister of Civil Aviation has directed that a detailed examination should proceed ot the Cliffe site from an operational and engineering standpoint, in order to determine the physical and financial implications of its possible development.

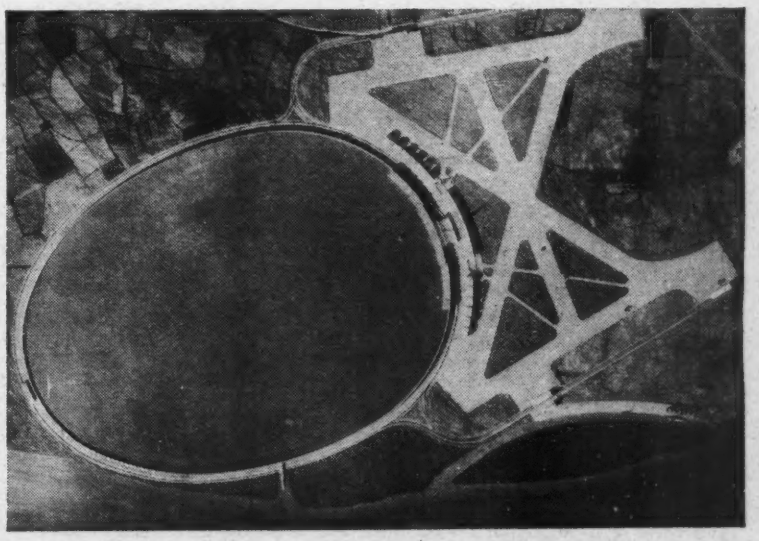
AIR SAFETY BOARD APPOINTMENT

THE Ministry of Civil Aviation have appointed as the fourth member of the Air Safety Board Professor A. A. Hall, M.A., Zaharoff Professor of Aviation and head of the Department of Aeronautics, Imperial College of Science and Technology. The professor was at the Royal Aircraft Establishment, Farnborough, from 1937 to 1945. The three members who were appointed when the Board was created in November are Lord Brabazon of Tara, Air Chief Marshal Sir Frederick Bowhill, and A.V-M. Sir Conrad Collier.

ANOTHER "FREIGHTER" TOUR

CAPT. K. J. G. BARTLETT, sales director of the Bristol Aeroplane Company, flew across the South Atlantic once again last week to negotiate further sales of the Bristol Freighter with the Argentine Government. It will be remembered that a contract for fifteen Freighters was signed last summer with the Argentine Purchasing Commission to the United Kingdom.

Capt. Bartlett also intends to complete the arrangements for establishing Bristol engine maintenance and repair depots in the Argentine and Brazil. This organization will be necessary in view of the considerable number of Freighters and Wayfarers which will be operating in South America very soon. The Shell Oil Company in Ecuador have ordered Freighters for the transportation of heavy machinery to the



THAMES AIRPORT? Model of an airport suggested by Mr. F. G. Miles and evolved by Mr. Guy Morgan more than three years ago. The layout is based upon the site at Cliffe, the recommended alternative to Langstone Harbour for development as a marine base.

CIVIL AVIATION NEWS

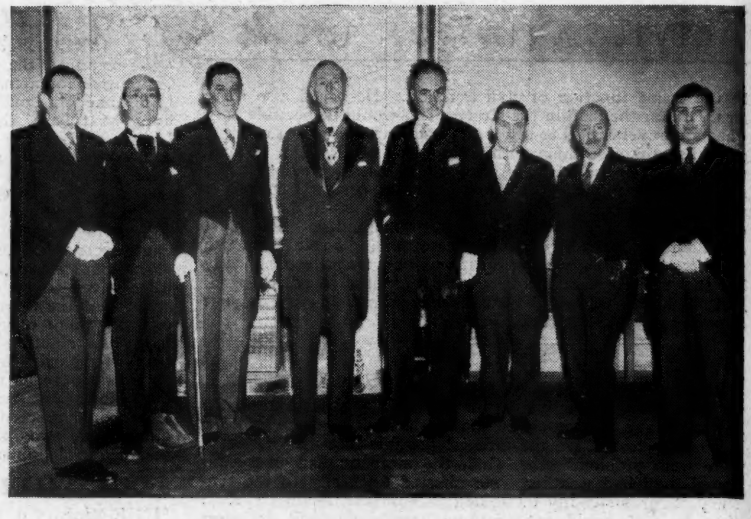
oilfields, and, of course, the Vickers Vikings, which are already operating in South America, are fitted with Bristol engines. Capt. Bartlett is expected back in this country in the middle of February, and will leave again shortly afterwards on an extended Freighter demonstration tour of the Middle East, Australia and New Zealand.

THE BERMUDA AND THE HALTON

ON the 820-mile route between Bermuda and Baltimore B.O.A.C. have been operating Boeing 314A flying-boats. It is now intended to replace these aircraft, which were purchased in 1941 and which flew on the trans-Atlantic route during the war, with specially modified Short Sandringham Mark VII flying-boats, to be known as the Bermuda class. They will differ from the Hythe, which is in use by B.O.A.C. on routes to the Middle East, India, Burma, Malaya, Hong Kong and Australia, in several ways. A faired nose and tail will alter the outside appearance, Pratt and Whitney twin Wasp engines will be fitted, and owing to the short time in the air on this route, sleeping accommodation will not be necessary. The all-up weight of the Bermuda is about 27 tons, and a cruising speed of 180 m.p.h. is obtainable at 10,000 ft. Three of these flying-boats have been ordered, the first of which is expected to be delivered about mid-summer.

At present the Boeing flying-boats are operating on three services a week in each direction, but the Corporation hope to increase the frequency with the Bermudas to a daily round trip.

There have been announcements in the daily Press that B.O.A.C. intend to replace the Dakotas, which are at present in service on routes to the Middle East, with Handley Page Haltons. It will be remembered that Haltons came into service with the Corporation several months ago, when it was announced that they would be used on the trans-Sahara and Cairo routes and ultimately on the routes to India. They were withdrawn from winter operation owing to unsatisfactory de-icing equipment, but it is hoped to have them in service again in about two months' time. The Haltons will, therefore, automatically replace Dakotas.



FORMAL OCCASION: The G.A.P.A.N. deputation received by H.R.H. Princess Elizabeth last week. Reading from left to right: G/C. W. N. Cumming, Mr. L. A. Wingfield, W/C. N. H. Woodhead (Deputy Master), The Most Hon. The Marquess of Londonderry (Master), S/L. R. C. Preston, M. J. Lankester Parker, G/C. P. W. S. Bulman and Mr. Ian L. S. McNicol (Secretary General).

GRAND MASTER OF G.A.P.A.N.

AT Buckingham Palace on the afternoon of Monday, January 27th, H.R.H. Princess Elizabeth graciously received a deputation from the Guild of Air Pilots and Air Navigators of the British Empire, headed by the Master, the Most Honourable the Marquess of Londonderry. The occasion was the formal acceptance by Her Royal Highness of the office of Grand Master of the Guild.

G.A.P.A.N. was founded in 1929, chiefly through the efforts of the late A.V-M. Sir Sefton Brancker, who was the first Master, and the late S/L. E. L. Johnston, who was the first Deputy Master. In 1936 the late Duke of Kent honoured the Guild by becoming its first permanent Grand Master, and those members who were then on the Court until the outbreak of war know what interest he took in the Guild and the work he did to promote its advancement.

It is hoped that affiliated branches will be developed in all the Dominions and throughout the Empire to build up an organization which will be in keeping with its title.

BREVITIES

IT is understood that the de Havilland Company of Canada has refitted the floats on the Fox Moth aircraft 5½in aft of the previous position. This gives greater visibility when landing on the water and allows a canoe to be strapped on top of the floats—a useful innovation for mining and hunting expeditions in Canada.

* * *

Two hundred war surplus aircraft were sold in Canada by the War Assets Corporation during November. The largest single transaction was the sale of a hundred Canso and Catalina flying-boats to the Charles H. Babb Company of Montreal. The total war surplus sales to the end of November have amounted to 1,814 aircraft for more than six million dollars.

* * *

A site eighteen miles north-west of Bergen has been selected as a suitable place from which the Sandringham and Junkers flying-boats of D.N.L. will operate on the Norwegian domestic coastal routes. The base, to be known as Herdla, is expected to be ready on April 1st. The first of the three Sandringhams on order was due for delivery at the end of last month, with the next to follow three weeks later.

* * *

The American domestic operating company, United Air Lines, have taken delivery of the first of their Douglas DC-6s. Thirty-five of these aircraft are on order, and it is expected that they will go into service early in the spring. Delivery is also expected of fifty Martin 303s and seven Boeing Stratocruisers. The company's present fleet consists of 106 passenger and freight aircraft.

The *Montreal Gazette* on December 28th published some interesting figures on accidents in various spheres. In the United States, for example, 75 persons were killed during the year in aircraft crashes, but in the same country in 1943, when the latest available figures were published, 1,378 persons were killed in level-crossing collisions and 23,823 in motor car accidents.

* * *

On February 10th Pan American Airways are starting a direct service from San Francisco to Manila, via Midway and Guam. This will cut the previous time from North America to the Philippines by twenty tour hours.

* * *

D.D.L. are expecting delivery of their first Viking about the middle of February, after which they will receive one a month for the next four months. The aircraft will be fitted with Gee, and it is understood that the D.D.L. radio operators are being trained on the equipment, although the present Gee chains do not cover Denmark. There are, however, stations in existence in Northern Jutland which can be opened up at quite short notice.

* * *

Mr. C. H. Dickins has been appointed assistant managing director of de Havilland Aircraft, Canada. For the past five years he has been vice-president and general manager of Canadian Pacific Airlines.

* * *

France and Brazil have signed an agreement defining the details of an air service between the two countries.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

A.M. VERSUS A.T.C.

A Promise is Being Kept

YOUR correspondent, "A Still-Keen-Regardless A.T.C. Flt. Sgt." (*Flight*, January 16th), has correctly recorded the promise, given to ex-cadets, of reduced periods of recruit training in the R.A.F. Administrative arrangements to give effect to this promise were completed by January 1st, and since that date are being fully implemented.

THOMAS COCHRANE
(Senior Press Officer, Air Ministry).

IN SEARCH OF SAFETY

A Few Practical Suggestions

WE appreciate that the M.C.A. has many difficulties at present, and we believe that the following constructive points might bear consideration.

Notices to Airmen.—Both M.C.A. and foreign N.A. appear in large quantities, causing numerous amendments, and requiring considerable time for assimilation. Reduce amendments to a strict minimum, and provide translations of foreign facilities available.

Signals Frequencies.—Choose frequencies, and stick to them—it causes much confusion if a crew is flying regularly and has to be always wading through piles of paper. Simplicity is surely the keynote.

M/F and QBI Facilities.—M/F D/F should be fitted at Manston, as this 'drome is used often as a diversionary field for charter aircraft. There should be separate channels for M/F D/F QBI procedure—and homing equipment should be located on runways in use—this to be maintained until all aircraft have been fitted with other equipment.

U.C.O.—No use, as "Q" code duplicates and only causes trouble. Decoding U.C.O. is a waste of time.

Station Two-Letter Characteristics.—Use the first and last letters of the 'drome name (e.g., Speke S.E., Hurn H.N.) for all purposes—signals, call-signs, flashing light beacon, general correspondence, etc. Standardize this for any one 'drome. Use red two-letter pundits on all civil 'dromes; white/green light is very indistinct.

Air Pilot.—Speed up the publication of a combined signals, 'drome lighting and facilities book—the time taken searching for required information is very disturbing at present.

"AIRCREW."

RADIO BEAM FLYING

A Dangerous Attitude of Indifference

I HAVE found that in both Service and civil flying there seems to be an attitude of complete indifference toward radio beam flying that is positively dangerous. Air training in this form of flying is almost non-existent with the result that faulty execution of procedures in emergency is inevitable.

The accident to the B.E.A. Dakota near Oslo last August gave point to this contention. That the captain had had no experience of an approach aid which he would obviously have occasion to use sooner or later deserves the fullest enquiry. It would also appear that the captain was not fully conversant with the use of the radio compass. This apparently resulted in the issue of a *Notice to Airmen* which gave some instructions in the use of this instrument.

Now, two years ago, I—a mere Link instructor—was passing on this same information to pilots in Transport Command. For a "let-down" procedure it is habitual to switch from compass to antenna, so as to receive the most accurate indications. That I knew this was because I had taken the trouble to get all my basic range information from those who knew all the answers—the U.S.A.T.C. But apparently B.E.A. had not made sure that their pilots were given full information on the equipment they were expected to use. In the case in question it is unlikely that this incorrect use of the radio compass would have had serious results if the pilot had maintained the minimum height laid down in the descent procedure instructions. That he did not follow out these instructions seems to suggest that—apart from inexperience—he was inadequately briefed, and also that he had not practised this particular descent in the Link. (K.L.M. have the right ideas there)

It cannot be professional jealousy which accounts for this apparent scorn for radio range, because S.B.A. has been treated in exactly the same haphazard manner. I wonder how many pilots can claim to be able to make an approach and landing on S.B.A. under the conditions in which Capt. Robinson put down his Lancastrian at London Airport recently? Very few, I would say, mainly because of lack of confidence due to insufficient air experience. And if air practices are carried out at all, then too often the pilot is not hooded. For shining examples of "practice makes perfect" the B.A.T. flight instructors are outstanding. They would use the beam under the most appalling conditions without a second thought. But, to an inexperienced pilot the beam is a snare and a delusion. Hence the many adverse comments passed about it.

Poor old S.B.A.; you've died before you were born! Coming in on SCS-51 will be like taking a ride on one of Mr. Butlin's scenic railways!

GRAEME PERCIVAL.

AIR ACCIDENTS

Publication of Enquiry Results

WOULD it not be possible to have published the result of all investigations into aircraft crashes, with also the opinion of the investigating body as to why the accident occurred and what steps should be taken to prevent similar accidents? Thus pilots would learn from others' mistakes.

Such a publication as I have suggested could be issued every two or three months and perhaps take the form of a civil "Tee Em." I am sure it would pay for itself and be most beneficial to all concerned as was "Tee Em" to the Services.

This publication need not necessarily be available to the general public.

A. COOKE-SMITH.

FLYING JOBS

Prospects for "B" Pilots

IT is high time that the field of employment for pilots in civil aviation should be authoritatively reviewed. It is obvious that all R.A.F. and Fleet Air Arm pilots cannot be absorbed in civil aviation. At present, there even appear to be more aspirants than there are jobs. The natural result is that those with the most useful qualifications are accepted. Of the others, those with determination who can afford to wait and, if necessary, obtain further qualifications, will be largely absorbed in due course.

In our Employment Advice Bureau we have a register containing some 300 names, with more being added daily. Of these, we have succeeded in placing a round 100 in aircrew jobs. Of the remainder, probably 50 are not looking for flying posts for reasons of age; loss of licence or personal inclinations. This leaves approximately 150 who hold "B" Licences, of whom not more than half a dozen hold the 2nd Class Navigator's Certificate as well. At the moment, almost anyone holding a 2nd N. can be placed, and no doubt this will be so for some time to come. It leaves, however, a hard core of pilots of 30 years of age or more whose flying experience is around the 1,000 hr. mark in Ansons, Oxfords, or very often only single engine types with no civil counterpart.

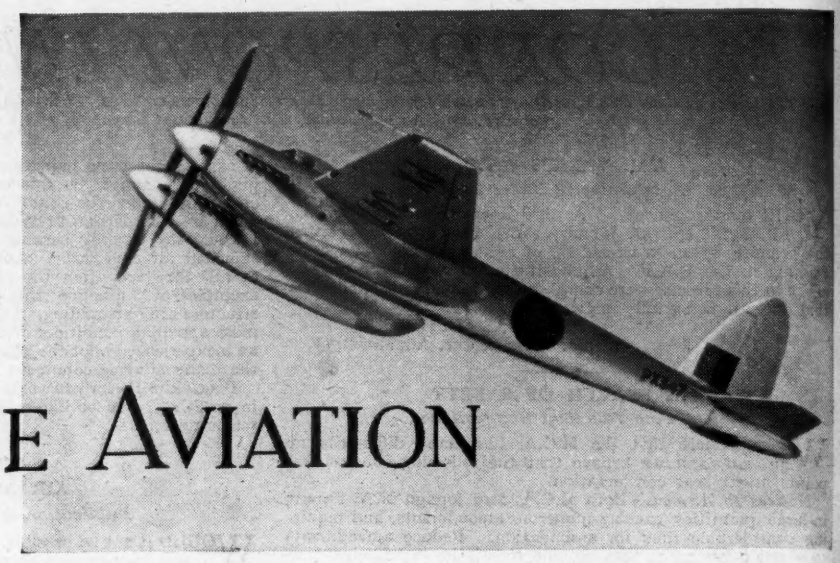
The present demand for pilots, still in large numbers, is generally limited by minima of 800 to 1,000 hr experience as pilots, with 200 to 250 hr. on twin or preferably four-engined aircraft. Civil qualifications required are "B" Licence *and* 2nd Class Navigator's Licence and, so far as the Corporations are concerned, an age limit of 27 is imposed. There is also a limited demand for navigators as distinct from pilots. On the estimated requirements of the three Government Corporations alone, these demands will continue for at least two years.

Releases from the Services are, however, falling off rapidly, so that in future the material available with the present requirements of practical experience will be progressively less. The object of this letter, therefore, is not to discourage the right men, but to place the prospects of employment in the right perspective.

There are many "planners" in M.C.A. and in the Corporations. The above facts and ideas are brought forward in the hope that they may be of assistance to them, while at the same time putting a clearer picture before the would-be civil pilot.

R. C. PRESTON.
(Employment Advice Bureau, G.A.P.A.N.).

Royal Air Force and Naval Aviation News and Announcements



UNNATURAL ATTRACTION: Students of natural history will refute any suggestion of beneficial association between merlins and hornets, but among students of aircraft design the climb of the R.-R. Merlin-powered D. H. Hornet is a by-word.

"Flight" photograph.

SERVICE AVIATION

Awards

THE King has been graciously pleased to approve the following award:—

D.F.C.

W/O. Edward John Betts, No. 97 Squadron.

An extract from the citation reads:—"During an attack on a site at Pronville, his aircraft was coned by searchlights for at least 15 minutes and, during this time, sustained four attacks by enemy fighters. The aircraft was riddled by cannon fire. The starboard outer engine caught fire and was rendered useless. The hydraulic gear was severed and the mid-upper turret put out of action. With great presence of mind and courage in the face of danger W/O. Betts climbed back from the bomb aimer's compartment and managed to feather the starboard engine while the aircraft was taking defensive action, thus giving his pilot great assistance in a moment of grave danger. During subsequent operations, whilst engaged in target marking, W/O. Betts displayed outstanding courage and devotion to duty."

Campaign Stars

R.A.F. flying personnel who were employed as aircrew on transport and ferrying duties, and medical officers and nursing orderlies employed in ambulance aircraft, are now eligible for the Atlantic, France and Germany, Pacific, Burma and Italy Stars, in addition to the 1939-45 and the Africa Stars. For the 1939-45 Stars the list of routes and special operations by which a candidate can qualify has been enlarged.

Appointments

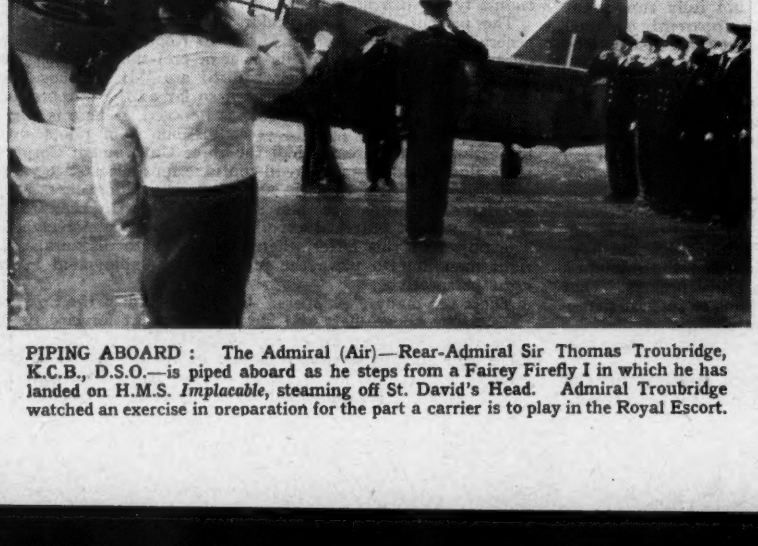
THE Air Ministry announces the following appointments:—

Air Commodore George Stacey Hodson to be Air Officer Commanding No. 205 Group, R.A.F. Mediterranean and Middle East, with the acting rank of Air Vice-Marshal.

Air Commodore Arthur Percy Ledger as Air Officer Commanding No. 23 Group Flying Training Command, from February 3, 1947, with the acting rank of Air Vice-Marshal.

Air Vice-Marshal Hodson has been Air Officer in Charge of Administration, Coastal Command, since last April, having previously commanded a base and been Air Officer in Charge of Training, Bomber Command.

Air Vice-Marshal Ledger has been Air Officer Commanding No. 28 Group, Technical Training Command, since June last year, and for five months previously he commanded No. 54 Group, Flying Training Command.



PIPING ABOARD: The Admiral (Air)—Rear-Admiral Sir Thomas Troubridge, K.C.B., D.S.O.—is piped aboard as he steps from a Fairey Firefly I in which he has landed on H.M.S. *Implacable*, steaming off St. David's Head. Admiral Troubridge watched an exercise in preparation for the part a carrier is to play in the Royal Escort.

Naval Gas Turbines

THE Admiralty has lately outlined its policy in the matter of gas turbine development and has indicated that the possible advantages of the gas turbine for ship propulsion have been realized for some time. Machinery of this type is now being developed for warships and coastal craft.

It is pointed out that during the war all available facilities for research and development of gas turbines were necessarily devoted to jet propulsion units for aircraft as these were essential to our defence programme. Gas turbines for warships, although desirable, were not vital.

The information gained in the development of jet propulsion units has been made available by the Ministry of Supply to the Admiralty, who have taken steps to interest firms, other than those engaged in the aircraft industry, in gas turbine work for warships. As well as this, some aircraft firms, by agreement with the Ministry of Supply, are forming marine wings

There are many problems: the longer life required for naval machinery; the provision of suitable reversing arrangements; the need to burn heavy fuel oil and the good cruising economy required. Gas turbines and jet units developed for aircraft have a life of 300-500 hours, whereas the life required for naval machinery is measured in thousands of hours.

High-powered, long-life units are to be developed by well-known aircraft and other firms and by the association of thirty marine firms known as Parsons and Marine Engineering Turbine Research and Development Association (P.A.M.E.T.R.A.D.A.).

Although it is emphasized that marine

SERVICE AVIATION

gas turbines present problems which are not encountered in aircraft practice, and that, generally speaking, aircraft units cannot be adapted for marine purposes, it is known that the Admiralty has in hand the development of gas turbine machinery suitable for coastal craft, in which an aircraft jet propulsion unit is incorporated. Development of gas turbine machinery suitable for an escort vessel is also in hand.

Reunions

IT is proposed to hold, in London, on the evening of Saturday, March 15th, 1947, a reunion of all past and present members of No. 51 Squadron. Will those who wish to attend communicate with F/L. T. B. Nisbet, D.F.C., No. 51 Squadron, R.A.F. Waterbeach, Nr. Cambridge, by February 28th.

A reunion dinner for officers of H.Q.221 Group, and of the wings, squadrons, and other units which served with that formation in Burma, will be held at the Waldorf Hotel, Aldwych, on February 21st. Application for details should be addressed to F/L. L. W. Stavers, Fighter Command, R.A.F. Bentley Priory, Middlesex.

"Aries II"

FLIGHT last week recorded the passing of the Lancaster *Aries I* and the acquisition of a Lincoln, *Aries II*, for the R.A.F. Empire Air Navigation School. It is now learned that the first flight of the Lincoln will probably be a tour to the Far East, to take place at the end of February. Modifications include the removal of the upper turret, the fitting of a second astrodome, installation of three 500-gallon fuel tanks in the bomb bay (giving a range of 4,700 miles), and the replacing of the nose and tail turrets by fairings. Sound-proofing and seats in the fuselage are provided and armour-plating and armament are removed. *Aries II* will fly uncamouflaged.

A.S.R. Helicopters

FOLLOWING trials by the Air-Sea Warfare Development Unit, R.A.F. Thorney Island, it is likely that the R.A.F. will use helicopters in future air-sea rescue operations. The Air Ministry has indicated that helicopters are now being designed and built in this country incorporating features which R.A.F. research has shown to be necessary.

Trials up to the present have been made with Hoverfly Is (Sikorsky two-seaters with a cruising speed of about 65 m.p.h. and a duration of about 2½ hours), but it is obvious that future A.S.R. helicopters must have greater power and better performance.

It is also recommended that accommodation should be provided for two passengers as well as for a pilot and observer and that a blind-flying panel and adequate radio equipment, including aids to navigation, should be provided A radius of action of 150 miles at a speed of at least 115 m.p.h. is considered necessary, and for the actual rescue operation the aircraft should carry hoisting gear capable of lifting at least two survivors in flying kit from the water.

Farewell to Cairo

AIR VICE-MARSHAL S. E. TOOMER, C.B., C.B.E., D.F.C., A.O.C. 219 Group, deputized for the A.O.C.-in-C. M.E.D.M.E. Command at a dance in Cairo, attended by more than 500 people, to mark the R.A.F.'s farewell to Cairo.

R.A.F. Winter Sports

A WINTER sports association to include ski-ing, skating and bob-sleighing has been formed in the R.A.F. and two teams have been sent to Switzerland by the R.A.F. Sports Board to represent Great Britain in the contests for the world bobsleighing championships and to train for the 1948 Olympic Games.

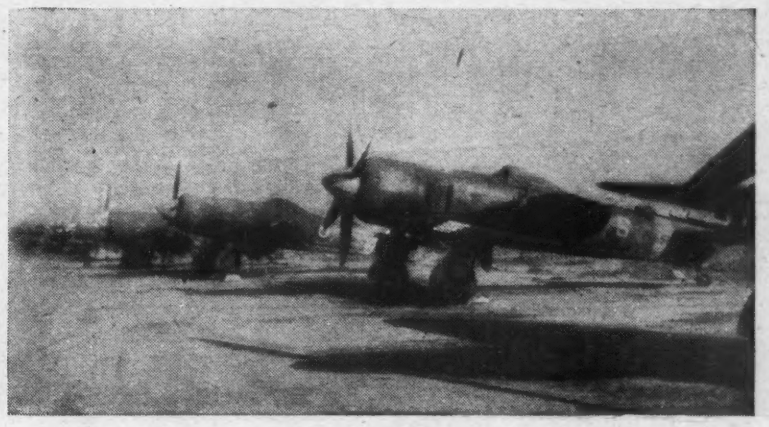
The teams, each consisting of four men and one reserve, are led by G/C. R. W. P. Collings, D.S.O., A.F.C., of the R.A.F. Record Office, Gloucester, and have been chosen from all ranks of the R.A.F. who have had any experience of or show any flair for this kind of sport. With the exception of one sergeant all the members of the teams are officers, but another sergeant, a blacksmith and sheet-metal worker by trade, is accompanying the teams as mechanic.

possibility of power-flying for cadets, more incentives for cadets, the formation of County Wings, permanent staff instructors for A.T.C. squadrons and better conditions for officers. One of the critics said that the Air Ministry should provide some real inducements to attract young officers into the A.T.C., and should not rely merely on the fact that the Corps could be a haven of refuge from their wives.

Sir W. Lindsay Everard, the host at a pleasant dinner which followed, was presented with an inscribed silver salver to mark his retirement, because of ill health, from the twin posts of Chairman of the Committee of the Leicester Squadrons and District Inspecting officer.

It had been intended that the salver should be subscribed for only by officers and committee members, but news of it having come to the ears of the cadets of the first A.T.C. squadron—No. 1 (Founder) Squadron, Leicester, they asked to be allowed to contribute.

A/Cdre. J. A. C. Wright, A.F.C., T.D., D.L., who has succeeded Sir Lindsay as Honorary Air Commodore of No. 605 (Warwick) Auxiliary Squadron.



RADIALS AND ROCKETS: Hawker Tempest IIs, with Bristol Centaurus V engines, of No. 20 Squadron, operating from Agra, India, famed for its Taj Mahal. Each aircraft is fitted with rails for eight R.P.s.

SERVICE AVIATION

D.F.C., D.F.M.; B. J. Jennings, D.F.M.; H. L. Lewis; C. K. Silcock, D.F.C.

Flight Lieutenants: J. A. Moss, D.F.C.; T. B. Nisbet, D.F.C.

TECHNICAL BRANCH

Wing Commanders: T. Bradley; J. Dean; R. A. Roy.

Squadron Leaders: A. D. Balmain; A. G. Barlow; N. G. N. Davis; W. E. Devonald; S. G. P. Ellender; H. R. Free, O.B.E.; F. A. B. Gaire, M.B.E.; A. H. Hope; T. H. L. Keast; J. L. Lendrem; R. T. Morrison, M.B.E.; G. W. Price; J. Rawlinson, A.F.M.; E. J. Watts, M.B.E.; R. H. Whipp, F. C. Wooley, M.B.E.

Flight Lieutenants: W. A. Appleton; S. H. Bacon; H. J. Bigmore; A. B. Bingham; F. T. Bolt; L. R. Brooks; T. M. G. Bury; D. A. Casley; L. A. R. Hunt; E. A. Jarman; C. H. Loder; J. W. McCombie, M.B.E.; S. D. A. MacEachern; G. Medd; F. J. Moden; F. B. Morley; C. R. Overton; T. C. Pinkerton, A.F.C.; H. T. Robinson; G. Satherley; J. M. Scruby; A. C. Shawyer; R. E. Smith; H. F. C. Stratton; C. H. Thomas.

Flying Officers: R. E. Chapman; W. Collingwood; W. E. B. Hurst; E. J. W. Mennell; R. J. Newman, B.E.M.; W. V. Reynolds; N. F. Ruse; J. D. Southall.

EQUIPMENT BRANCH

Flight Lieutenant: F. J. P. Haynes.

ACCOUNTANT BRANCH FOR SECRETARIAL BRANCH

Squadron Leaders: D. R. Anderson; R. J. K. Baker, M.B.E.; W. E. Bottomer; R. P. Breen; C. Bryant; G. H. Earp; F. E. Evans; F. W. W. Hollingham; T. John; J B. Lewis; J. C. Lister; F. R. Oxley; R. Porter; S. Robinson; W. L. Whittaker.

Flight Lieutenants: E. J. Baldock; W. H. Bangs; H. P. Butler; J. Chartres; A. T. S. Edwards; D. F. Forbes; D. C. Fortescue; H. Jagger; W. D. Lewis; M. J. Morris.

DENTAL BRANCH

Squadron Leaders: O. B. Balean, L.D.S.; R. M. Brown, L.D.S.; A. J. Clegg, L.D.S.

CHAPLAINS BRANCH

Rev. O. F. McL. Campbell, B.A. (U.B.); N. Collinge (U.B.); E. Davies, B.A. (Pres.); J. C. Harkus, M.B.E. (U.B.); G. Hyslop, M.A. (C. of E.); E. C. H. Tribbeck (Meth.).

R.A.F. REGIMENT

Squadron Leaders: R. J Cody; J. A. Kemp; A. I. Mitchell, M.C.; C. F. Price.

Flight Lieutenants: V. M. Crowshaw, R. Millhouse, M.B.E.

CATERING BRANCH

Wing Commander: N. H. Bennett.

Squadron Leader: C. F. Kevis.

Flight Lieutenants: J. H. Fuller; K. C. C. Hicks; K. R. Manns; A. S. Pattie; W. T. H. Sharp.

PROVOST BRANCH

Squadron Leaders: W. G. Parry; N. F. T. Robinson; P. Stradling.

Flight Lieutenant: A. J. Harper, D.F.C.

The majority of these officers had been previously selected for extended service commissions.

FOREIGN SERVICE NEWS

Netherlands Honours

SIXTEEN British and Polish Air Force officers flew to the Netherlands by K.L.M last week to attend an investiture at Soestdijk Palace and receive decorations from Prince Bernhard. They were the guests of the Netherlands Air Force and were due to return in a transport aircraft of that Service. The following are the officers and decorations:—

British: Officer Order of Orange Nassau.—W/C. F. Instone, S/L. R. C. W Barnes. *Flying Cross.*—W/C. H. W. Bird Wilson, W/C. W. A. B. Oxspring, S/L. J. H. Bryant, S/L. A. Vincent, F/L. L. P. Boucher, W/O. A. D. Dalton, W/O. I. Davies, W/O. J. Howe.

Polish: Commander Order of Orange Nassau.—A. Cdre. L. Szul-Skjöldkrona.

Testing U.S. Turbines

THE use of Wellington and Lancaster airframes as flying test-beds for British gas turbine units has already been reported . The Americans are likewise utilizing standard aircraft, including the Douglas A-20 Invader, and a particularly interesting trial installation has been made on a Boeing B-29 Superfortress. A General Electric gas turbine is carried internally in the bomb bay and is lowered beneath the aircraft for test and observation.

Flights with the jet unit in operation have already been made at heights ranging between 8,000ft and 40,000ft, and the aircraft is fully instrumented for measuring and recording thrust and for checking the operation of various commize drag on the Superfortress when the unit was not in use. For the present, the B-29 test-bed is used exclusively by General Electric, but the U.S.A.A.F. has considered adopting a similar installation to instruct pilots in the operation of gas turbines.

Royal Norwegian Air Force

SERVICE flying in Norway, and the organization of the Royal Norwegian Air Force, are suffering badly from post-war budgeting and demobilization. Only now is the equipment, the supply of which was agreed between Norway and England last year, beginning to arrive.

General Major Öen, the Air Officer Commanding in Chief, has stated in an erview that conscription will be plied on a basis of one year's service all eligible, those selected for cialist training (pilots, navigators, ipment and medical personnel) being ained for 18 months. A limited num- will be given what amounts to a ort-Service Commission and regular vice will, of course, be available for se interested.

The specialist instructors loaned by the A.F. have returned home and training now given by R.N.A.F. personnel who eived instruction in England during 45. No more general courses in Eng- d are to be requested but a small mber of officers for specialist training, ., for test pilots, radar and C.F.S. tructors' courses, may be sent.

t is not intended at present to super- e the Mosquitoes and Spitfires by jet- pelled aircraft.

The main weakness of the R.N.A.F. in its technical trades and ground anization and these are to be cially developed to provide a sound is for the Service as a whole before ision of the equipment programme.

At present, the R.N.A.F. has a trans- t squadron equipped with Catalinas, -3s and Lodestars. These aircraft are internal use and for the supply of Norwegian contingent stationed in rmany.

5TH, 1947

CH

bbell, B.A.
E. Davies,
ns, M.B.E.
C. of E.];

T

Cody; J. A.
C.; C. F.

Crowshaw,

CH

Bennett,
is.
H. Fuller;
nns; A. S.

H

Parry; N.
g.
J. Harper,

rs had been
nded service

ss when the
present, the
lusively by
.A.A.F. has
installation
ation of gas

r Force

y, and the
Royal Nor-
ering badly
nd demobi-
ipment, the
ed between
year, begin-

Air Officer
stated in an
n will be
ear's service
elected for
navigators,
onnel) being
imited num-
nounts to a
and regular
vailable for

oaned by the
and training
ersonnel who
land during
rses in Eng-
out a small
ist training,
and C.F.S.
sent.
nt to super-
fires by jet-

e R.N.A.F.
and ground
are to be
ide a sound
whole before
rogramme.
has a trans-
h Catalinas,
e aircraft are
e supply of
stationed in